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VOL. XIV. NEW YORK, SEPT. 21, 1889. No. 12.

Western Union Earnings. THE returns of the Western Union Company for the current quarter are a good indication of the improvement in business throughout the country. The company is in receipt of the largest net revenues shown for many years past. At the present rate the company is paying 5 per cent. per annum, but it has cleared that in nine months, so that the stock ought soon to be paying 6 per cent, and possibly 7, for the prospects of large earnings were never better. Unfortunately, both the cables of the company are reported broken, and there may be a heavy drain for repairs, though the company would, of course, still receive its pro rata from the pool" earnings.

The Telephone Convention. IN this issue we present our readers with a report of the Telephone Convention held at Minneapolis last week. But for the fact that the convention sat with closed doors the best part of the time, our report would be fuller; but it will suffice to give an excellent idea of what was done and of the present state of the art in America. We can heartily congratulate the association on its new president, Mr. W. D. Sargent, of Brooklyn, who is one of the best representatives of those who have given their energies and talents to the advancement of telephony.

An Electric Road for Liverpool. IF it be true that Liverpool is to have an elevated electric road, the situation in England with regard to electric railways is more hopeful than some writers would lead one to imagine. It is said that the contract has been awarded for six miles, the track running parallel with the Liverpool dock system, which many of our readers will remember as stretching along the Mersey so solidly. Such a road should be profitable. It is not stated whether the road is to be devoted to freight as well as passenger traffic, but if the track be equal to the strain it would seem likely that a large amount of freight could be handled.

The Production of Aluminum. OF late years the attention of many electricians has been seriously given to the production of aluminum, and the result has been some very marked advances in the art. Aluminum is not yet so cheap as some people would like to see it, but, thanks to electricity, it is being brought well within reach for many uses for which it had hitherto been regarded as impossibly expensive. In this issue we illustrate and describe the Hall electrolytic process for obtaining aluminum, now being worked at Pittsburgh. It would appear to be at once practicable and successful, giving new promise of the coming Age of Aluminum.

Devising Lightning Arresters. THE description of an improved lightning arrester by Mr. A. R. Bennett, in our issue of Sept. 7, has called forth remarks from quite a number of prior claimants to the device, once more corroborating the old adage, "There is nothing new under the sun." We publish this week an interesting article describing a similar form devised by Mr. A. B. Ker, late General Manager of the Pennsylvania Telephone Co., with whom it has been in use for two years. But this reference is "gone one better" by the claim of Latimer, Clark, Muirhead & Co., London, in a letter to the English *Electrician*, who describe the apparatus as invented by Prof. Andrew Jamieson, of Glasgow, and as manufactured by them and in practical use for the past *thirteen* years. Invention sometimes repeats itself.

Johns Hopkins University. A FEW days ago the friends of higher education in this country were greatly alarmed at the report in one of the New York daily papers as to the hopelessly crippled financial condition of Johns Hopkins University, as the result of the unproductiveness of its Baltimore & Ohio railway stock. It is a great relief to learn from President Gilman that the story is a wild exaggeration, and that the University begins its next year on Oct. 1 with unimpaired efficiency. Even with its curtailed permanent revenues, the University can maintain all its educational staff and agencies for the next three years, and even add to them; and if at the end of that time the University is not placed above pecuniary troubles by the liberality of its well-wishers, we shall be greatly mistaken and disappointed. Short as has been its career, Johns Hopkins has already done a magnificent work for our nation, and it cannot be spared from among the elevating influences of the land.

The Paris Electrical Conference. WE complete in this issue Mr. Wetzler's special report of the international conference of electricians at Paris, and we feel sure that it will be read with the utmost interest. The proceedings, which extended over a whole week, embrace a great variety of work, practical as well as theoretical, and the authors of the papers and participants in the discussions were among the leading scientific men and electricians in Europe. All that was said and done, therefore, has special importance, and will have a direct influence on the immediate future of electricity. At the close of his report Mr. Wetzler gives the new units and definitions adopted by the conference; and it will be admitted that electrical terminology has received some valuable additions. In fact, if the more advanced members had had their way, the list of new units and expressions would have been even longer than it is. As matters stand, electrical science can now get along pretty well till the next conference in America, in 1892.

Half-Open Doors. IT seems to us that while the members of the telephone convention who desire to sit with closed doors and keep their transactions to themselves, are very much in the wrong, they may fairly expect their wishes to be regarded in the matter. We have therefore given in full the papers, all of which were prepared with the idea of publicity, and in printing which there is certainly no breach of confidence; while it is equally certain that no harm can come. With regard to the discussions, however, we have abstained from giving those in extenso, for the reason that they were conducted in private and in secret, when the members deemed themselves free from interlopers and eavesdroppers, and when, therefore, matters were discussed with much more freedom than would have been the case were the doors wide open and the representatives of the press in attendance. It is proper to add, however, that nothing would have been easier than to give the discussions very fully, owing to the desire of some members for all possible publicity, on the wise and proper ground that there was nothing to hide, and that while mystery had its charm it also invited suspicion.

The Business Outlook. NEVER have business prospects shown up as brightly as they do to-day. The volume of business transacted by the electrical industries is constantly growing larger, compelling every manufacturer to increase his capacity, in many instances doubling it, while all the supply houses have prepared for an enormous demand for construction material from contractors and parties constructing line circuits, etc. In this connection the personal replies from agents specially sent out by the manufacturers of arc and incandescent supplies to report on the probability, as well as the advisability, of electric lighting plants being installed in the smaller interior towns, are interesting reading, as they state that the indications of the securing of heavy crops of both fruits and cereals have instilled a buoyant feeling in the hearts of merchants everywhere, almost without exception, and that many orders for plants may be expected from locations not heretofore enjoying the blessings of electric light. Many small Western towns are also reported as profiting from the transient trade gained from the laboring forces engaged in extending railway lines, which are being laid in anticipation of the requirement of unusual transportation facilities during the fall and winter season.

Wealth from Rapid Transit. THE facts presented recently by the St. Louis papers regarding the increase in travel in St. Louis on street car lines introducing a means of rapid transit, while merely a repetition of the general results already noted in other cities, are of value in showing the hearty willingness of the public to patronize any system that affords greater facilities than have been previously enjoyed. Certain railway lines in St. Louis introduced the cable system and discarded horses, the change resulting in the patronage being doubled, the capital stock of one of the companies increasing in value from $160 to $350 per share, and the value of property in the vicinity of the line increasing above 25 per cent. Yet, with all these advantages gained, and in spite of the debt incurred in making the improvements being still unpaid, some of the more enterprising companies, anticipating the demand that the public will make for further improvements, are about to discard the cable system, and have contracted for the installation of an electric motor system. This will afford a still more rapid means of transit, yet the operating expenses and cost will be greatly lessened. In other words, they will confer a greater favor on the public, and in so doing reap their reward in better dividends. It is noteworthy, in the same connection, that the electric motor is also to replace the cable in Kansas City, that four electric railway franchises have been granted at St. Paul, Minn., and that every street railroad company in Milwaukee has asked for the right to use electricity.

A Few Telephone Statistics. IT is the custom of the secretary of the National Telephone Exchange Association to prepare and present a statistical report, and this year the work has been done by General Barney, as usual. The document appears to fall among the matter that the association considers its own property and not for general information, and was not read. From the copy in our possession, however, a few interesting and harmless figures are gleaned. It appears, for example, that Boston this year shows a gain of 48 per cent. over last year in the number of subscribers—a really remarkable growth for an old exchange. Grand Rapids leads in the development of territory, having 1 subscriber to every 27 inhabitants, but Portland, Ore., has 1 to every 30, and Portland, Me., 1 to every 42. Among the larger cities, Brooklyn shows up creditably with 1 to 220, and New Orleans with 1 to 188. As to the use of the telephone, Richmond comes to the front with 17.1 daily calls per subscriber, followed by Atlanta with 14.3; Detroit, 12.6; Boston, 12.5. Strange to say, San Francisco reports only 1.6 calls per subscriber. The operators at Richmond do the most work, and those at Jersey City apparently do the least, though probably they don't think so. In 22 out of 87 exchanges listed for comparison, the operators are doing more work than in 1888. General Barney closes his interesting returns with the statement that only eight out of forty-eight exchanges reporting on the subject have had experience with underground work—New York, Brooklyn, Boston, Detroit, Pittsburgh, Buffalo, Washington and Louisville. It is boasted by Pittsburgh that the exchange there has underground conductors in use that have been working successfully since they were first laid in June, 1882, over seven years ago.

The British Association Meeting at Newcastle-on-Tyne.

By Commercial Cable from our Special Correspondent.

NEWCASTLE, Eng., Sept. 13, 1889.—The meetings of the British Association for the Advancement of Science have an international reputation on account of their size and the number of papers presented by leading men. The meeting this year at Newcastle, now going on, will prove no exception to the rule. No fewer than 2,000 persons are in attendance, and it seems as though every scientist of fame in England had put in an appearance. The president is Prof. W. H. Flower. Captain Abney is president of the Mathematical and Physical Science Section and Sir Lowthian Bell of the Chemical. Mr. W. Anderson is president of the Mechanical Science Section.

There is as usual a good showing of electricians, but the attendance of Americans is not at all large, most of them being still in Paris or on their way home to America. Among the authors of papers are Lord Rayleigh, Sir William Thomson, Silvanus Thompson, W. H. Preece, Dr. Oliver Lodge, Prof. Ewing, Maj. Gen. Webber, Prof. George Forbes, J. W. Swinburne and Killingworth Hedges. The meeting is now in full swing, and the proceedings are varied by soirees, lectures, excursions, etc. The association will be in session until some time next week.

WETZLER.

Our London correspondent writes: This day next week the British Association will commence its third visit to Newcastle-on-Tyne. Its previous visits to the great coal metropolis were in 1838, when the Duke of Northumberland was president, and in 1863 when Lord Armstrong presided. This year Professor Flower of biological fame will take the presidential chair. The electrical papers announced so far are not very numerous, although doubtless their number will be largely augmented before the first day of the meeting. Dr. Oliver Lodge is down for a paper on "The failure of metal sheets to screen off the electro-static effect of moving charges;" Mr. Preece gives a paper on "The heating effects of alternate currents upon conduction of different metals;" Prof. Silvanus Thompson will speak about "Sparkless electro-magnets", and "A phenomenon in electro-chemical solution of metals." Lord Rayleigh has two or three papers, and no doubt Sir William Thomson will also contribute something valuable. In Section G. there will be several practical papers from practical men. Mr. William Webster will give an account of his sewage process, Mr. E. C. Manville will talk about the Northfleet Electric Tramway, the Phonopore will be described by Mr. Langdon-Davis, and Mr. Killingworth-Hedges is down for a paper on "Distribution of Electricity by Underground Mains." A joint meeting of sections A and G will probably be arranged to hear Professors Rücker and Thorpe on the "Magnetic Survey of the British Isles," and although there will be no vigorous debate like that which took place last year on the subject of lightning conductors, the joint meeting of the sections will no doubt give rise to a discussion of much scientific interest.

NEW BOOKS.

MODERN VIEWS OF ELECTRICITY. *Nature Series.* By Oliver J. Lodge, D. Sc., LL.D., F. R. S., New York and London. Macmillan & Co., 1889. 5¼×7¼, 422 pages, Price $2.

The theory advanced by Dr. Lodge in this work to explain the phenomena of electrical action is the etherial one—a rough statement of which would be that electricity and ether are identical; and he seeks to explain the identity of two aspects of one ether, corresponding to positive and negative electricity.

The book is divided into four parts:

1. Electricity under strain, or electro-statics.
2. Electricity in locomotion, or current electricity.
3. Electricity in whirling motion, or magnetism.
4. Electricity in vibration, or radiation, commonly called light.

With regard to the ancient fluid theories of Franklin and Symmer, Dr. Lodge, in Chapter I., says: "*It is their foundation upon ideas of action at a distance that condemns them, not the fluidity.*" Electricity is to be considered as being withdrawn from one body and given to another, the bodies being elastic. The hydraulic illustrations of Leyden jar phenomena are fully explained, as being the key to the greater part of electro-statics.

In the second portion, conduction, current phenomena and production are discussed. In treating of magnetism, the comparison is drawn between a coiled wire conveying a current and a permanent magnet, and every current of electricity is shown to be virtually a coil of more less fantastic shape.

The ampèrian currents are not producible by magnetic experiments, but pre-exist, and the act of magnetization consists merely in facing them round so as look mainly one way—in polarizing them, in fact. The idea of electricity in the several molecules of the insulating medium, connected like so many cog-wheels gearing into one another, and also in those of the metal, enables us to picture a sideways spread of rotation brought about by the current.

In the fourth part the electro-magnetic theory of light is developed—that light is an electrical disturbance, and that light waves are excited by electrical oscillations.

At the end of the book are appended some lectures on the relation between light and electricity, the ether and its functions, and the discharge of a Leyden jar, all of which bear directly on the subject of the book. Throughout, analogies and explanations, supporting the various theories put forth, by means of diagrams, are numerous, the idea of the ether being put forward with the greatest conviction by Dr. Lodge. The book is one that needs careful reading. It furnishes a vivid idea of the way in which the abstruse problems of science and natural philosophy are being brought nearer a definite solution, and in many respects it marks a new departure, if not for the philosopher, at least for the reading public, to whom these views, set forth so ably, will come with an air of novelty.

ANNUAL REPORT OF THE HEBREW TECHNICAL INSTITUTE, NEW YORK. Press of De Leeuw & Oppenheimer, New York, 1889.

This report on the work done at the Institute, 36 Stuyvesant street, is a most interesting document, and shows that already some highly encouraging results have attended this effort to promote industrial knowledge and skill among young Israelites in this city. The work is a noble one, and has been assisted by liberal donations from rich members of the Jewish community, who are to be commended for their generosity and intelligent appreciation of public needs. It is to such institutions as these that, in the failure or lapsing of the old apprenticeship system, we must look for the maintenance in America of a high standard of skill among our artisans.

It is interesting to observe that attention is paid in the course of study to electricity, a feature for which probably Dr. Otto A. Moses is to be thanked, as he is an active member of the directorate. The pupils are well grounded in electrical principles, and go so far as to construct a variety of electrical apparatus. Thus, should any of them display any taste for electrical pursuits, they are ready, on leaving the Institute, to take positions where they can be at once of value to themselves and their employers. Dr. Leipziger, the director of instruction, gives details of the general working of the system in his report, and is to be congratulated upon the fruits exhibited even at this early stage.

THE ALTERNATING CURRENT TRANSFORMER IN THEORY AND PRACTICE. Vol. I. By J. A. Fleming, D. Sc., M. A. The "Electrician" Printing and Publishing Company, London, 1889. Illustrated. 8¼ × 5, 487 pages.

This is a most important, timely and valuable work. The need of a book dealing with the phenomena of periodic or alternating currents has been cruelly felt the last year or two, and while the whole subject is not treated in this first volume, enough is here presented to earn for the author the thanks of every one interested in this great branch of electrical investigation and practice.

In the first volume the general electro-magnetic induction phenomena and effects are treated in a very thorough and able manner, it being the intention that the second volume, which will appear shortly, shall deal with the subjects of practical measurement, construction, design and the applications in various fields. The first chapter chiefly deals with and explains Faraday's fundamental researches and experiments, the conception of "lines of force" being rendered remarkably well by means of an analogy of the links of a chain between the circuit and the lines. The author next explains the various phenomena of electro-magnetic induction, calling especial attention to "inductance" or self-induction, which has such a supremely important bearing on all alternating current effects, taking the place, so to speak, of the ohmic resistance in a circuit traversed by a steady current. Hysteresis in iron is shown to be of two kinds—*static hysteresis*, which is a quality of iron, in virtue of which reversal of magnetization is accompanied by dissipation of energy in the form of heat, something quite apart from any heat produced by eddy (or so-called Foucault) electric currents induced in the mass, and would take place in iron so perfectly divided that no eddy currents could exist; and, second, *viscous hysteresis* due to the *time lag* of magnetization, which may be supposed to introduce a sort of *magnetic self-induction*. In Chapter III. the properties of simple periodic currents and various geometrical curves are treated in which two states can be distinguished—the variable and the steady condition. The fundamental equation for varying or periodic currents when the periodicity is not so rapid as to affect the uniform distribution of the current over the cross section of the wire and neglecting the electrostatic capacity is

$$E = Ri + L\frac{di}{dt}$$

which might read in words

Impressed E. M. F.	=	Effective E. M. F.	+	Counter E. M. F. of self-induction.

In the latter part of the chapter some measurements of periodic current and E. M. F. and power are worked out by means of the Siemens electro-dynamometer, Cardew's voltmeter and a wattmeter. It concludes with an examination of the mutual induction of two circuits of constant inductance.

Chapter IV. is apportioned to mutual and self-induction, commencing with a description of Prof. Joseph Henry's researches, followed by the various experiments of Mason, Breguet, Blaserna and others; the actions of magnetic screens are discussed, and Professor Hughes' induction balance and sonometer is described, together with his experiments. The modern view that a current is put into a wire at all points of its surface by energy absorbed from the surrounding dielectric is mentioned. The author cites various experiments, etc., showing that the correct form for a conductor carrying a periodic current is tubular. The characteristic curves of series and parallel transformers are shown to be in the former case an ellipse, and, therefore, a series connection of the primary, running glow lamps in parallel in the secondary cannot be self-regulating. In the latter case, on the contrary, the curve is nearly a straight line, and, therefore, it will be perfectly self-regulating under constant primary E. M. F. The remainder of the chapter is confined to the efficiency of transformers, the experimental results of Professor Ferraris and the influence of eddy currents in the core upon mutual induction.

The fifth and last chapter is devoted to the dynamical theory of current induction, considering first Maxwell's theory and his conception of electric displacement, which is quantitatively defined by saying that in a homogeneous non-crystalline dielectric, if a plane be drawn perpendicular to the line of action of the resultant electric force, then under the operation of this electric force the quantity of electricity displaced normally across a unit of area of this plane is called the electric displacement. The subject of electric oscillations is discussed, as well as the function of a condenser in an induction coil to increase its action, as first suggested by Fizeau. Dr. Hertz's researches on electric oscillatory induction are very fully gone into, and in conclusion are put forward considerations on the propagation of electro-magnetic energy, and Professor Poynting's analysis of the whole phenomenon which has enabled him to formulate his important law on the subject, namely, that the energy dissipated in each section of a conductor is absorbed into it from the dielectric; which enables us to calculate the rate of supply.

The whole volume throughout is a very complete and masterly treatise on the subject of electro-magnetic induction of the alternate current transformer, both from a mathematical and a practical point of view, and will be of infinite use to the student in these subjects in explaining the various phenomena and effects, and similarly to the engineer, who obtains many valuable suggestions in the construction of his apparatus.

A Form of Electrical Sunstroke.

In a recent number of the *Revue d'Hygiène*, M. Maklokoff, of Moscow, relates his experiences of an "electric sunstroke" received at the Benardos Electric Welding Works at Kolomno, near Moscow, where it seems there is great difficulty in getting the workmen to work more than two hours a day, on account of the injurious effect of the arc, although they are paid very highly. The current at the Kolomno works is obtained from 500 Planté accumulators, and an arc 5 centimetres long is produced. In order to obtain personal experience of the effects of an "electric sunstroke," and to be in better position to suggest a remedy, M. Maklokoff exposed himself for about ten minutes to the light of the naked arc at close quarters. The outcome of this *experimentum in corpore vili* was, as will be seen, somewhat unpleasant. Two hours later a tingling sensation, combined with burning of the eyes and skin, was experienced. This was followed by a cold in the head and watering of the eyes, tumefaction, discoloration of the skin of the face, neck, and hands, chemosis of the eyelids, and photophobia. A feverish night followed, and next day there was increasing œdema. On the third day there was a deepening in the brickdust color of the skin, which commenced to crack and peel. The chemosis and pains in the eyes disappeared, when a secretion in the conjunctiva began to show itself. Subsequently there was desquamation of the skin, as in erysipelas. M. Maklokoff attributes all these effects to the chemical action of the rays, and suggests that a glazed taffety veil, placed on a wicker headpiece, and provided with grey glass eyelet-holes, should be worn by those employed in the Benardos process and analogous operation.

Lamps from Small Dynamos.

To the Editors of The Electrical World:

Will you kindly inform me through your valuable paper whether a 2 h. p. Roper hot air engine will run a dynamo of 100 volts, requiring 3,000 revolutions of the armature?

MT. VERNON, N. Y. A. C. SEIBOLD.

ANSWER.—Your engine should run about 10 lamps per h. p., each of which at 100 volts pressure would absorb approximately .6 ampère, making the output of your dynamo 12 ampères at 100 volts. You do not state the current your machine is designed to give, so that it is impossible to tell the number of lamps it is intended to run.—EDS. E. W.

Edison and His Inventions at the Paris Exposition.—IV.

BY W. J. HAMMER.

(*Copyright*, 1889.)

THE EDISON ELECTRIC PEN.

Edison's electric pen and duplicating process, as shown in Fig. 19, consists of a hollow pencil containing a steel shaft, having a needle point at one end and attached by an eccentric to the shaft of a tiny electric motor placed upon the top of the pencil or pen. The motor, when attached to a battery by a flexible wire, attains a wonderful speed, which causes the needle point to puncture the paper in a continuous manner as the pen passes rapidly over the surface. This sheet, which may contain a letter, picture or plan, is used as a stencil, which is placed in the frame of the duplicating press, where it may be used to reproduce thousands of exact copies upon sheets placed underneath, when the inked roller is run over its surface. This useful and novel invention has met with extensive use, and was followed by many imitations and modifications. Mr. Edison has also devised a pneumatic stencil pen and a perforating pen operated by foot power.

THE EDISON MIMEOGRAPH.

The Edison mimeograph for manifolding autographic and type-writing, etc., is one of the many appliances which followed in the wake of Mr. Edison's electric pen, such as the cyclostyle, horograph, etc. It is without doubt the simplest and most economical substitute for the electric pen, but the process, as a whole, comes directly under the patents of Mr. Edison on the electric pen. The apparatus consists of a finely-grooved steel plate, over which is placed a sheet of thin sensitive paper. The writing is done with a smooth steel stylus, about the size of a lead pencil well sharpened, which glides easily over the paper, as the corrugations in the steel plate are so fine and so close together as to afford practically no resistance; while it causes the paper to be perforated from the under side, and, as with the electric pen process, forming a stencil sheet, from which thousands of copies may be taken by inserting the sheet in a frame and passing an inked roller over it in the usual manner. When used for manifolding type-writer work, a sheet of prepared stencil paper is used, over which is placed a perforating silk, and both are passed through the type-writer and written upon the same as any ordinary letter, with the exception that no ribbon is used.

THE EDISON VOTE RECORDER.

The Edison vote recorder, shown in Fig. 20, provides a means by which each member of a legislative body can, by moving a switch upon his desk to the right or left, register at will his name upon a sheet of paper under the head of the "yeas" or "nays." For instance, Mr. Jones, whose desk is to the right, has placed his switch to the left, which causes his name on the "no" column to appear upon the sheet of paper (which is chemically treated), when the iron roller representing the positive pole passes over the type; the number of votes taken each time is indicated upon "yes" and "no" dials operated by electric magnets, the circuits of which are completed each time the circuit is closed by the roller passing over a name. This is Edison's first patent.

THE MAGNETIC ORE SEPARATOR.

This invention of Mr. Edison's was devised for the purpose of separating magnetic from non-magnetic substances. It was invented in 1880, and is shown in principle in diagrams 1 and 2, Fig. 21; and in order to represent graphically the separation of the iron ore from the silicious sand and other substances of non-magnetic character, I have shown the crushed iron ore falling from the hopper past the poles of an electro-magnet, which alters the trajectory of the iron ore and draws it toward the magnet and causes it to fall in a bin or receptacle under it, while the non-magnetic particles, influenced only by a gravitation, fall straight downward into a bin under the hopper. Diagram 1 shows the standard type of apparatus as used to-day, comprising the crusher, screen, hopper, elevator, magnets, etc.

This method of working ore is claimed to be not only the simplest yet devised for separating the largest percentage of ore of any system, but to be available for the working of classes of ore which are too poor to work by other methods, as well as being particularly appplicable to the working of magnetic or black sand found in large quantities in many places.

THE MAGNETIC BRIDGE.

Mr. Edison, reasoning upon the principles underlying the Wheatstone bridge, believed that they might also be applied for testing the quality of iron purchased for the construction of dynamos, as well as the detection of flaws in steel or iron, and he constructed an instrument alike in general principle to that employed for electrical measurements, which should exercise the same functions in magnetic measurements. Its construction is extremely simple, and is shown in Fig. 22. It is a typical Wheatstone bridge in the form of a rectangle, the ends or poles of the electro-magnet being connected to the middle of the short sides, while the bars which pass inward to the needle are joined to the middle of the longer sides. The four halves of these longer sides constitute the sides of the bridge; the two at one end of the rectangle are fixed, and two at the other end are movable. The two bars which pass inward to the needle are curved so as to form a semi-circle standing above the plane of the rectangle; the needle and mirror are suspended to a wire attached to a torsion head shown in diagram 2.

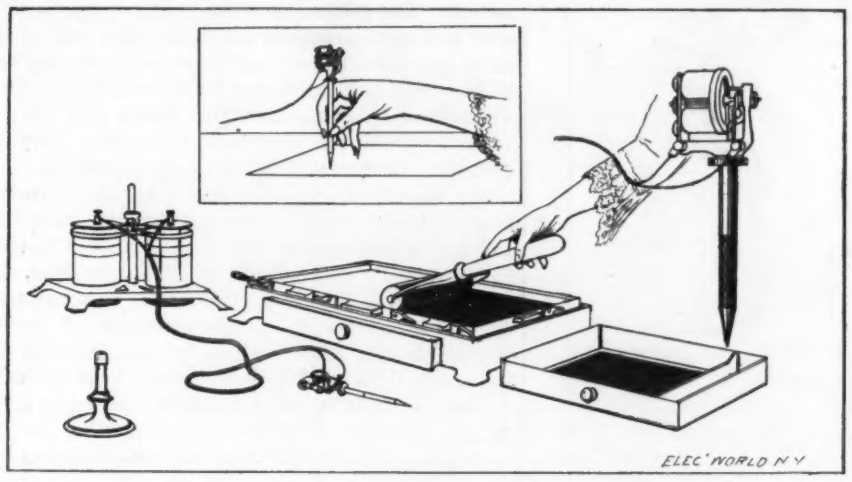
It will be readily seen that when the electro-magnet is charged, a constant difference of magnetic potential is maintained at the two ends of the rectangle, so that if the four bars constituting the sides of the bridge are magnetically identical there will be no difference of magnetic potential between the ends of the bars which pass to the needle, and hence there will be no deflection; but if one of the movable bars be loosened, the needle is at once deflected, and in a direction depending upon the side the bar occupies. If the bar be entirely removed the deflection is maximum, of course. And if it be replaced by another bar differing in cross section, in quality of iron, or in any other way which affects the magnetic conductivity through the bridge, the deflection shows at once the amount of difference between that bar and the original one taken as a standard. The instrument is extraordinarily delicate, and the principal difficulties encountered in using it have arisen in the attempt to preserve this delicacy while at the same time the range of the apparatus is maintained.

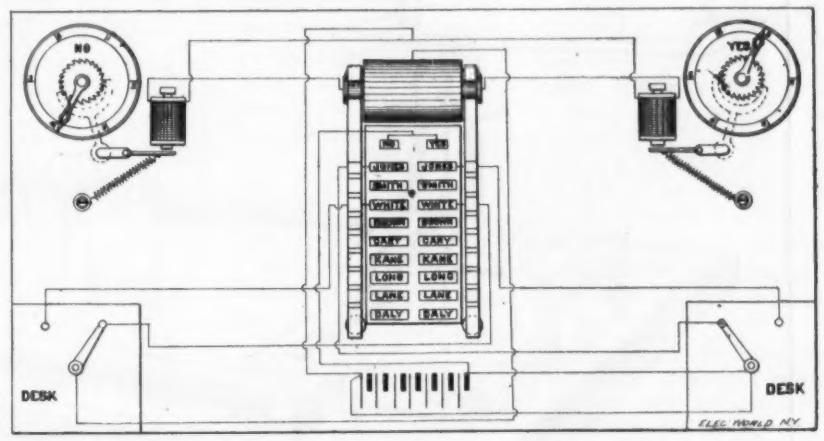
Constructed with sufficient care and attention to details, this instrument would prove of great value in researches into the laws of magnetic conductivity for paramagnetic and diamagnetic bodies, as well as into the influence of heat, strain, pressure, etc., upon magnetized bodies.

DEAD BEAT GALVANOMETER.

Diagram 1, Fig. 23, represents a form of dead beat galvanometer invented by Mr. Edison in 1880. It consists of a glass tube, with a large bulb on one end, from which the air has been exhausted, and mounted upon a pivot which admits of lateral adjustment upon the tripod supporting frame, with the usual leveling screws. A fine platinum iridium wire runs through the tube, terminating at one end with a platina wire sealed into and through the glass, and the other end wound a few times about a vertical wire of aluminum, delicately pivoted, and to the centre of which a tiny mirror is affixed. The lower portion of the supporting frame is sealed into the glass bulb, through which it protrudes, forming a connection to the commutator on the base of the instrument, as does the wire at the other end of the tube.

Upon the upright shaft carrying the mirror a fine platinum iridium wire is wound and attached at its ends to the shaft and the supporting frame of the same, thus placing the shaft under torsion strain. This instrument—which in principle is the same as the well-known Cardew voltmeter, which it antedates—depends upon the heating effect of the current, which causes the fine platinum iridium wire in the tube to expand, allowing the coiled spring to turn the shaft and mirror in proportion to this heating effect, and indicates the same upon a scale, by a reflected beam of light thrown upon the mirror.





FIGS. 19 AND 20.—EDISON ELECTRIC PEN AND VOTE RECORDER.

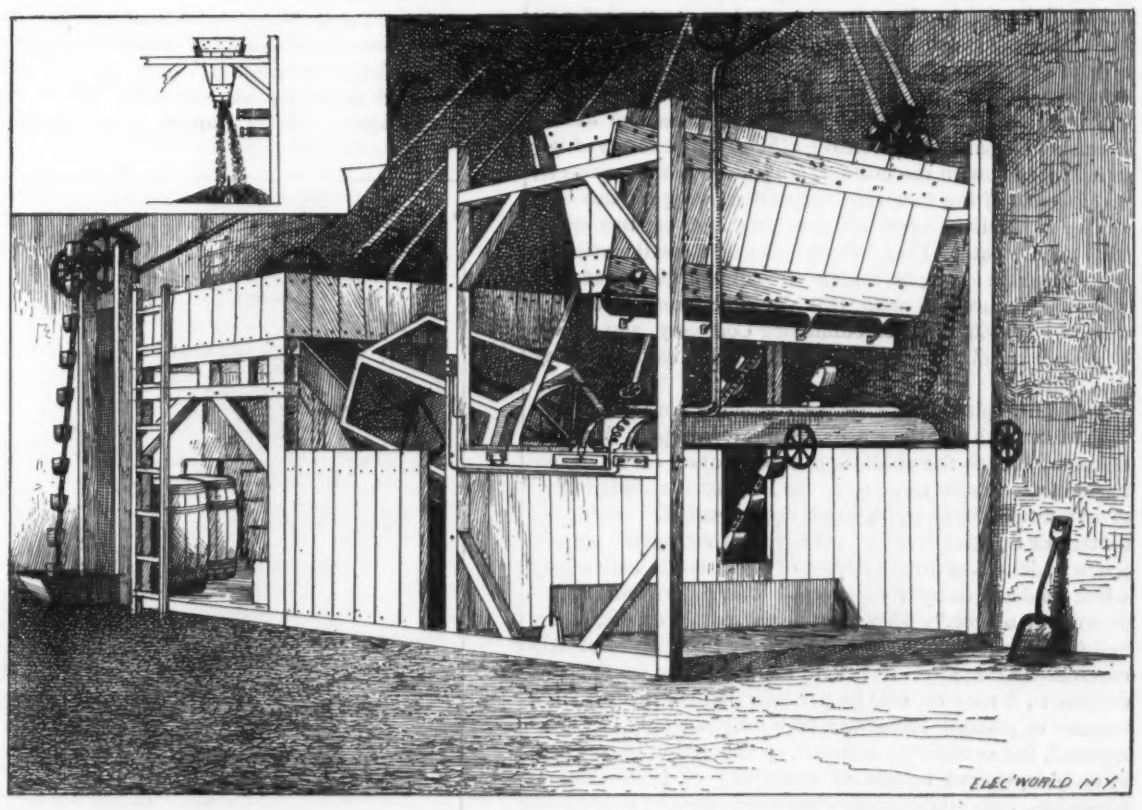


FIG. 21.—THE EDISON ORE SEPARATOR.

THE PHONOMOTOR OR VOCAL ENGINE.

In Mr. Edison's experiments upon the telephone and the phonograph, he discovered that the vibrations of the vocal chords were capable of producing considerable dynamic effect; this he applied in an ingenious instrument which he terms a "phonomotor," or "vocal engine."

Referring to Fig. 23, diagram 2, it will be observed to consist of an ordinary diaphragm and mouth-piece; to the centre of the diaphragm is a brass rod carrrying a steel pawl, which acts upon a ratchet wheel with exceedingly fine teeth, which is mounted upon a delicately pivoted shaft, carrying a fly-wheel and driving a colored plate.

The vibrations of the voice, in talking or singing into the mouthpiece, produce a rapid rotation of the fly-wheel, as the pawl is caused to impinge upon the teeth of the ratchet wheel, while blowing produces no effect whatever; a continuous sound gives the fly-wheel such momentum as to necessitate a considerable force being used to stop it. Mr. Edison says there is no trouble in boring a hole through a board or sawing wood, so that it is really within the limits of practicability for a man "to talk a hole through a board."

Its greatest utility is doubtless as a means of measuring the strength or force of sound waves.

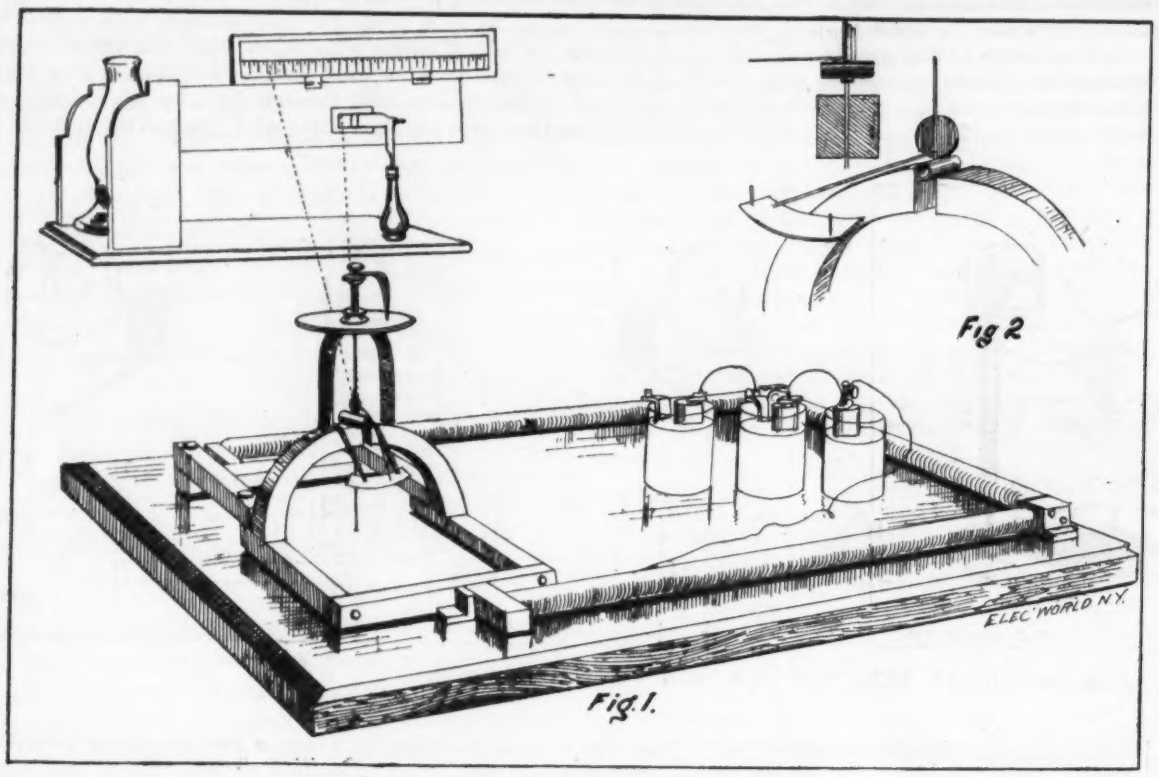


FIG. 22.—THE EDISON MAGNETIC BRIDGE.

What Constitutes a Storage Battery?

To the Editors of The Electrical World:

In your issue of the 20th of July, 1889, you were kind enough to publish an account of my inventions and system of electrical distribution. In that article you described and illustrated my storage battery plate. In view of the statements now being made by the Electrical Accumulator Company, that, since the decision in their favor by Judge Coxe, in February last, in their suit against the Julien Electric Company, they control absolutely all forms of accumulators now in the market, and in use in this country; and in view of the fact that they are striving for this control by injunctions upon all concerns and persons using such accumulators, I beg leave to take up a small portion of your valuable space, in which to call attention to several points in connection with this decision, some statements made by the Electrical Accumulator Company, and also to this plate of mine, which is the essential element of my accumulator.

In the first place, it should be distinctly borne in mind just what the limitations are which are set up by the Coxe decision, both to the public and to the patent of the Electrical Accumulator Company. In his decision, Judge Coxe gives a definition of what, in his apprehension, a secondary battery or accumulator is. He says: "A secondary battery is one which gives no electricity of itself, but is active only when rendered so by a current (of electricity) from an independent source." This view is shared by others, and is insisted on as correct by the experts of the Electrical Accumulator Company. Without attempting to combat this definition, it may be said in passing, that there are a large number of primary batteries which may not only be partly restored, but completely restored, by the action upon them of an independent source of electricity to their original condition, and so be made to perform over and over again all the functions of secondary batteries, for it is also believed by a very large portion of scientific investigators that an electrical accumulator or secondary battery is any one in which chemical energy can be stored up when acted upon by an independent source of electricity, and which will then give a current of electricity of itself.

A primary battery, one which gives electricity of itself, without being acted upon by an independent source of electricity, according to this definition, cannot be an accumulator or secondary battery, so that if a perforated plate or grid has the active material applied to it in the form of a paint, paste or cement, prior to immersion in the electrolyte, and which is practically insoluble in the electrolyte, but which will give a current of itself, without being acted upon by an independent source of electricity, it is a primary battery according to this definition, and does not come within the scope of this patent.

The limit, therefore, set by this decision to the public is not to make or use a secondary battery electrode to which the active material has been applied in the form of a paste, paint or cement prior to immersion in the electrolyte, and which is practically insoluble in the electrolyte, and which will give no electricity of itself, but is active only when acted upon by a current of electricity from an independent source, and to the Electrical Accumulator Company, to control only an electrode for a secondary battery, to which the active material has been applied in the form of a paint, paste or cement prior to immersion in the electrolyte, and which is practically insoluble in the electrolyte, and which will give no electricity of itself, but is active only when rendered so by a current of electricity from an independent source.

As electrodes for secondary batteries or accumulators are usually made, the plates when immersed in the electrolytic fluid are identical in composition. When a current of electricity from an independent source is passed through a cell constructed of such plates, the final result of its action is to render a part of the plates highly electro-positive, and a part highly electro-negative, thereby putting them in condition to do chemical work and deliver electrical energy when arranged under proper conditions so to do. Secondary battery or accumulator plates, as ordinarily constructed, are perforated plates or grids of lead, pasted with oxides of lead, and immersed in an electrolyte of sulphuric acid and water. After being acted upon by an electric current a part of these plates becomes highly oxidized, their active material being changed to peroxide of lead, and part become hydrogenized or reduced to sponge lead, in which condition the cell is active, and will give a current of electricity of itself until both sets of plates become alike again, or are equally oxidized. If in the first place, however, the plates or grids be pasted, the one part with peroxide of lead, and the other with sponge lead, and then immersed in a solution of sulphuric acid and water, the cell will be a primary cell, and will be active at once without any aid from an independent source of electricity. The difficulty with this form of plate has been the inability to paste peroxide of lead into a perforated plate and make it stay there when immersed in the electrolyte. If this can be successfully accomplished, the the plates so made will form a true primary battery and will in no way conflict with or come under the ban of the claim of the Electrical Accumulator Company.

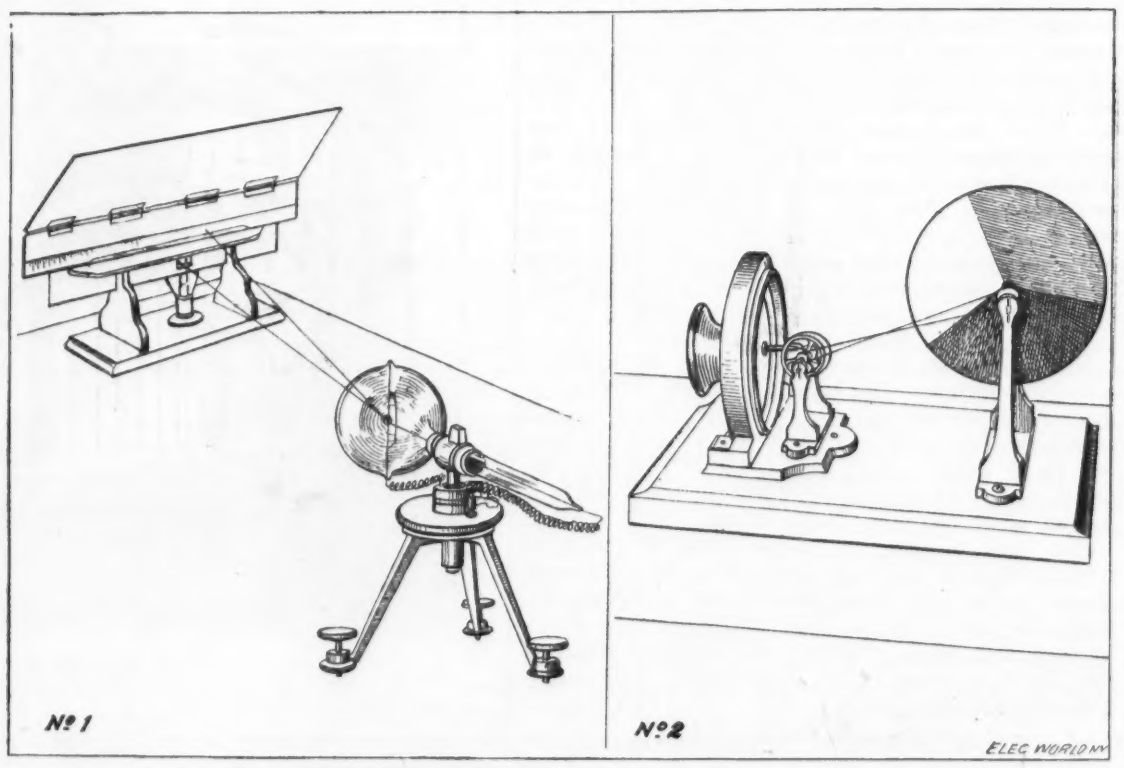


FIG. 23.—EDISON GALVANOMETER AND PHOTOMOTOR.

There are other ways, however, of making first-class accumulator plates than by means of applying the active material in the form of a paint, paste, or cement; one of which is to fill the perforated plate or grid with the active material in the form of a dry powder, compressed by pressure so as to fill the plate with a solid, coherent mass, which, if properly prepared and manipulated, will be as porous as it is necessary for an accumulator plate to be, and which, when formed by the action of an electric current, will do all that a pasted plate will do, and more, and be a much better plate than can be made by the pasting process. The porousness of the electrode has been harped upon and made to appear as the *sine qua non* of a storage plate; but this is not all that is necessary, by any means, as all who have had experience with accumulators know, and a compressed plate can be made which will have all the necessary porousness combined with other very valuable qualities not obtainable by the pasting process.

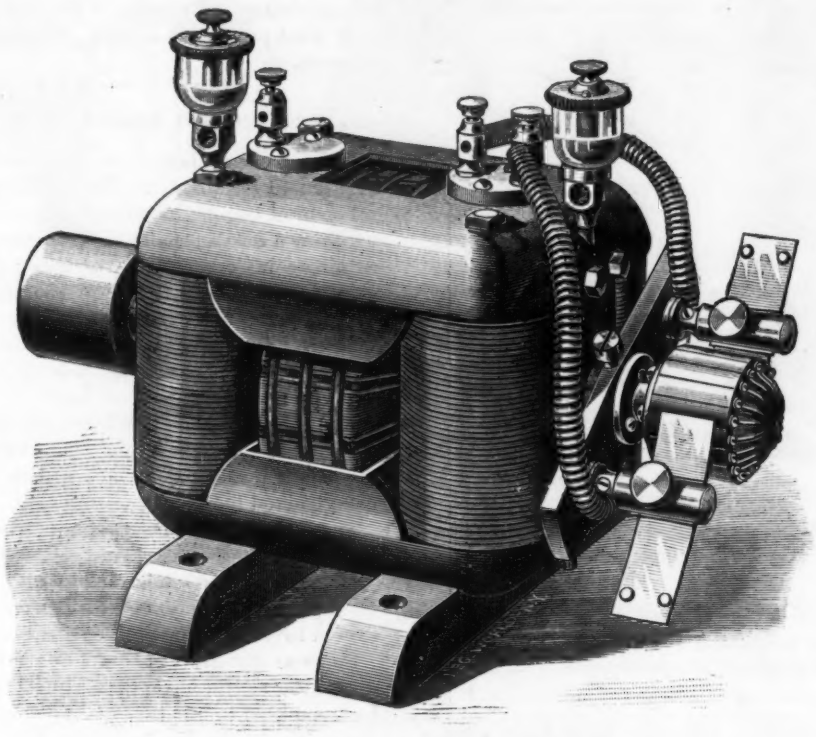
The statement has been made by the experts of the Electrical Accumulator Company that this cannot be done, and they adduce certain experiments to back up their statements; but the fact remains that it can be done, and very successfully, as numerous plates, made by a compression-of-dry-powder process, now in the possession of the writer of this article (and made and used by him), can readily testify. This method of making electrodes, it is understood, is claimed by Mr. Charles F. Brush, is covered by some of his patents, and is now the subject of litigation. Another way to make a suitable electrode for accumulators is to compress the active material in the form of a dry powder into solid masses of given form, and then to either cast or form the metal of the plate proper around such masses, or to introduce such pieces of compressed active material into previously prepared plates or grids in such a way as to fill up the cavities in them. This method is the one adopted in a measure by the writer, and it is in such a manner that the before mentioned plate, illustrated in your paper, is made. This form of plate is made under Patent No. 291,850, issued to the writer in January, 1884, which covers a plate formed of alternate plates of lead and compressed active material, perforated and riveted together. This electrode as made, consists of two plates of lead, or an alloy of lead, which are perforated, and which fit, the one to the other, and each is made with a recess in one side, so that when they come together a space or cavity is left between them. Into this cavity is introduced the active material in the form of a slab or plate of compressed dry powder, and the plates are then riveted together, forming a compound electrode, which is then ready for immersion in the electrolyte. The active material may be in the form of a peroxide of lead and sponge lead, in which case the battery will be primary in character, or the active material may consist of litharge or minium, and the battery will be secondary in character, and need to be acted upon by an external source of electricity before it will be itself active. This form of plate overcomes the defect inherent in all pasted plates of whatever form, viz.: the tendency to falling out and scaling off of the active material when subjected to severe and long continued strain, either electrically or mechanically, and also the tendency to buckle or curl. Some such form of plate as this is the coming plate, which will successfully fill all the requirements of electrical storage for all purposes for which it may be needed.

E. R. Knowles,

Brooklyn, N. Y., Sept. 14, 1889.

The Nutting Electric Motor.

If the rules promulgated by Carl Hering and others governing the construction of dynamo electric machines are closely followed, the resulting apparatus will probably prove of high electrical efficiency, whether it be of commercial value or not, though this follows. Thus the important factors to be considered in building either dynamos or motors is to so design the parts that the cost of material and construction will be reduced to the minimum consistent with long life. These were some of the points considered in designing the motor illustrated on this page,



THE NUTTING ELECTRIC MOTOR.

which the inventor, Samuel E. Nutting, of the Nutting Electric Manufacturing Company, Chicago, describes as follows:

The field is symmetrical in form, having no projecting points, arms, legs or base of any kind to divert the magnetism or cause an unequal strength or action of the lines of force upon the armature. The pole pieces are uniform in every way, and, together with the cores and coils, form a field which is nearly a solid uniform block of iron and copper, leaving only a channel for the armature to revolve in within its centre in one direction and a narrow opening between the coils for the shaft in the other, at right angles.

The circulation of the current in the coils causes the upper half of the block to become magnetized with one polarity and the lower half with the other within which the armature revolves. The circular channel for the armature is of the same diameter as the field and is cut through its four sides, two of these being in opposite sides and in the centre of the poles, with the object of improving the ventilation. The cores of the coils are solid projections from the pole pieces and join in their centre, which allows of the coils being wound upon hollow spools independently in a machine, and also allows of the pole pieces and cores being cast in one piece and fitted together with very little work.

A special metal, made by a new process and having very nearly the same proportion and component parts as "Swedish iron," is cast into the desired shape from patterns for these pole pieces. The metal is soft, tough and malleable, and its point of saturation as a magnetic material is very high.

The armature, which is nearly enveloped in a channel between the poles, is a ring with closed circuit winding and connections, constructed especially with a view to strength and good ventilation. The iron ring is divided by fingers projecting from the spokes, into sections, leaving air channels between, while the coils wound about it are supported independently of each other and stand apart on the outside, leaving channels crosswise, and thus allow an air circulation through to the iron and around the coils.

Four small sizes of these motors have been built, and when tested with a Prony brake delivered power as follows:

Weight.	Speed.	H. P.	Current.	Floor space.
60 lbs.	2,000	½	10 ampères	6½ × 6½ × 8
100 "	1,800	1	10 "	8 × 8 × 10
200 "	1,600	2	10 "	10 × 10 × 12
440 "	1,400	4½	10 "	12½ × 12 × 15.

Electricity at the American Association Meeting.

BY PROF. H. S. CARHART.

The proportion of papers on electrical subjects at the recent Toronto meeting of the American Association for the Advancement of Science was not large—not so large in fact as at some other meetings of recent years. The address of the chairman of the section—the writer—was on an electrical topic, and was entitled "Review of Theories of Electrical Action," but papers in the department of electricity did not predominate.

Dr. Eddy, of Cincinnati, read a mathematical paper, which discussed Professor Rowland's recently published equations, and developed them in certain new directions. The discussion related to the change in the velocity of light, due to the rotation of the plane of polarization in a magnetic field. By making one constant zero Professor Rowland finds a slight increase of the velocity as the effect of magnetic rotation; Dr. Eddy, on the other hand, shows that a diminution of the velocity will result if another constant is made zero. Professor Morley, of Cleveland, was ready with a plan to determine the question experimentally by means of the differential refractometer devised by Michelson and himself. The council of the Association, upon request of the physics section, voted $250 from the research fund to enable Professor Morley to carry out this research. It will furnish another test of the truth of the electro-magnetic theory of light.

A quadrant electrometer with some new features was described by Mr. H. J. Ryan, of Cornell University. The mirror attached to the supporting fibre is a steel disc magnetized along a diameter, or it may have a small magnet attached to the back of a silvered mirror. The quadrants, needle and mirror are inclosed in a coil, so that the system is subjected to both electro-magnetic and electrostatic action, and the couple due to the electrostatic attraction and repulsion is balanced by one due to the electro-magnetic effect of the current in the coil.

The needle and one pair of quadrants are connected to one side of the circuit to be examined, and the other pair of quadrants to the other side. An observation consists in adjusting resistances in series with the deflecting coil till a balance is effected. It is thus a zero instrument, and errors due to lack of symmetry are said to be eliminated. It has also a very wide range, and has been successfully applied to alternating machines and converters for the purpose of obtaining curves of primary and secondary E. M. F. The writer presented a paper on "Magnetic Leakage in Dynamos," and one on "An Improved Clark Standard Cell, with Low Temperature Coefficient." Both these papers will appear in due time.

The president of the association, Prof. T. C. Mendenhall, the new Director of the Coast and Geodetic Survey, read an interesting paper on "Globular Lightning." It was historical in character, gave details of the most reliable cases, and concluded that the phenomenon must be admitted to be a real one, though we have no experimental evidence of electricity in this form. The discussion brought out the interesting fact that several members of the association had been eye-witnesses of electric fire balls. Among them were Professor Putnam, the Permanent Secretary, and Professor Dolbear. The latter once saw a small fire ball roll along a railroad track and disappear at a joint between two rails, when he found himself in the midst of a thunder clap.

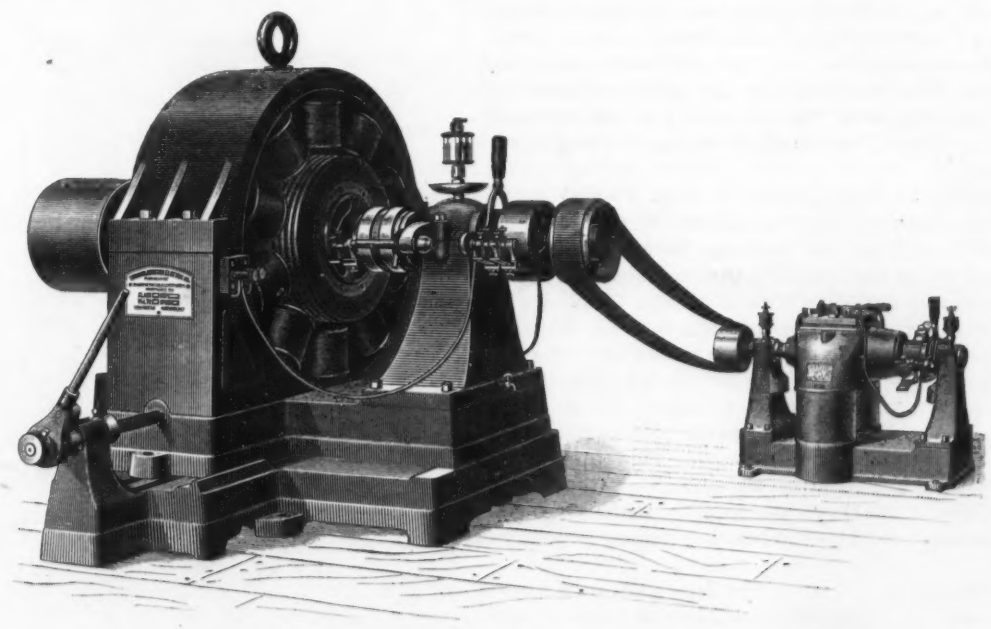
Prof. Geo. F. Barker, of Philadelphia, read a paper on "Recent Improvements in Storage Batteries." A zinc-peroxide-of-lead battery has recently been brought out after tests extending over two years' time. The negative plate is composed of well amalgamated zinc and copper riveted together. No E. M. F. is set up between two such amalgamated plates. The positive plate is built up of a large number of thin lead plates covered with graphite and riveted together with lead rivets about an inch apart. The compound plate is then perforated with numerous small holes. The graphite keeps the plate apart and allows the solution to penetrate into every portion, so as to reach the entire lead surface. The electrolyte is an acid solution of zinc sulphate. No active matter in the form of lead oxides is applied to either plate; but the positive is strictly a Planté plate of very large surface. During the charging process the positive is peroxidized, and metallic zinc of a beautiful crystalized appearance is deposited upon the negative.

These cells show an enormous increase in storage capacity per pound of metal as compared with cells of the Faure type. A table of comparisons with several other cells was given which exhibited the superior storage capacity of this new claimant. The new cell permits of any rate of charging and discharging, and is exempt from the usual danger of sulphating. In fact, in this respect it resembles the original Planté, which is much less liable to suffer from rapid discharge or from exhaustion than the Faure form.

The Thomson-Houston Alternating Current Dynamo.

The Thomson-Houston alternating current dynamo shown in the accompanying cut is essentially a machine of modern design and possesses features, electrical and mechanical, which render it valuable in central stations for long-distance incandescent lighting. It can be readily taken apart for examination, and is provided with spherical boxes, which allow a perfect alignment of the bearings. These are interchangeable, as are all parts of this class of machine, and can easily be removed and replaced if necessary. The armature has a most valuable feature in its ventilation, whereby tendency to excessive heating and consequent burning out is successfully overcome.

The Thomson-Houston Company has made an especial point of self-regulation in the design of its alternating current dynamo, and this has been so well accomplished that any number of lamps may be thrown on or off without affecting in any degree the brilliancy or steadiness of those remaining. In the winding of the dynamo fields and armature the utmost care is exercised, and a high quality of insulation is maintained, which is of the utmost importance where high potentials are used. These dynamos are made of a capacity of 500, 650, 1,000 or 1,300 16 c. p. lamps, and are operated both self and separately excited. The exciters used are of the motor type, as shown, and are well made and efficient. All the other details of the system are not less complete.



THE THOMSON-HOUSTON ALTERNATING CURRENT DYNAMO.

The Philadelphia Edison Company has been cited by Director Wagner to answer for illegally tearing up the streets. Professor Marks, the general manager of the company, says that the law has not been violated, and that the city officials are acting rather hastily.

Hertz's Experiments Repeated by Joubert.

M. Joubert, the French scientist, has repeated the greater number of the remarkable experiments of M. Hertz, professor at Carlsruhe, published during of the years 1888-1889, with the assistance of M. de Nerville at the Central Laboratory of Electricity in the Place Saint Charles, with results which completely confirm them. These experiments, it will be remembered, have a great interest on account of the exact information gained by their means of the intervention of the external medium in electrical phenomena, and as showing that there is an identity of nature between electrical and luminous phenomena.

The Hall Process for Producing Aluminum.

Among the recent developments in electro-metallurgy is a new electrolytic process for the manufacture of aluminum, patented by Chas M. Hall, of Oberlin, Ohio, and now being worked by the Pittsburgh Reduction Company, of Pittsburgh, Pa. This process has been developed within the past year at an experimental plant erected by them, in which operations were begun last December, and in which is now produced more pure aluminum daily than was the entire output of the world a few years ago. The process is a direct one, and consists of the electrolysis of the oxide alumina, from which the metal is produced pure in one operation. The only further treatment required to put the metal into a marketable form is re-melting and casting, to free it from any adherent electrolyte. A fused bath is employed, consisting of metallic fluorides which are less easily decomposed than alumina, and have a lower specific gravity than the reduced metal, which sinks to the bottom of the bath and is thus prevented from re-oxidation. The ore, or alumina, is dissolved in this bath and decomposed by an electric current of low voltage, the oxygen going to the positive pole and the aluminum to the negative pole. This current also serves to keep the bath melted. The pot in which the reducing operation takes place is represented in the drawing, and consists of an iron box about 24 inches square and 20 inches high, heavily lined with gas carbon. Two of these pots are at present employed and are supplied with current from two large dynamos which are connected in parallel, developing 20 volts and 1,800 ampéres. The pots are connected in series.

Each pot contains a fused bath of from 200 to 300 pounds of the electrolyte, and the current is conducted into it by means of a number of three-inch carbon cylinders, which form the positive electrode, the pot lining forming the negative. The arrangement of the line and the direction of the current will be readily understood from the drawing. Each pot takes from 8 to 10 volts, and the bath is maintained at a moderate red heat by the waste energy of the current. The ore is added in small quantities as required, the metal being ladled from the bottom of the bath about once a day, the production being, under ordinary circumstances, a pound of metal per hour from each pot.

A voltmeter connected with each pot indicates any variation from the normal working, such as the exhaustion of the ore from the bath. The process is a continuous one, the pots running for weeks at a time, day and night, without stopping.

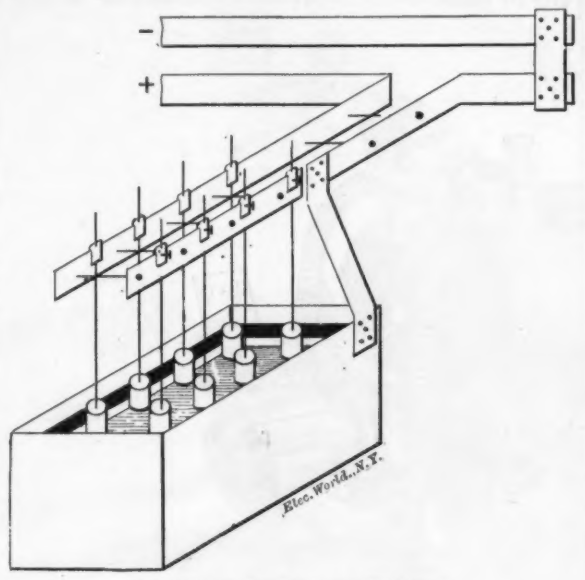
A modification of this process has been worked out for the manufacture of aluminum bronze; in this about the same bath is used, but the electrodes, instead of being made of carbon, are of copper. The reduced aluminum alloys with the copper of the negative electrode, forming a rich aluminum bronze, and, knowing the rate of deposition, the percentage of aluminum in the bronze can be regulated to a nicety. The oxygen going to the positive electrode soon forms a thin film of oxide of copper on its surface, which protects the body of the metal from further oxidation, the oxygen passing off as such. This thin film of oxide does not interfere with the passage of the current, for while oxide of copper at ordinary temperatures acts as an insulator, yet at a red heat it becomes a good conductor.

Pure aluminum has heretofore been made on a commercial scale exclusively from the chloride or fluoride; the last great step in the cheapening of the metal having been the Castner process for the manufacture of cheap sodium and the production of cheap and pure aluminum chloride, from which the aluminum is reduced by the sodium.

The great advance which has been made in the Hall process is evident from the fact that it is direct, all others being indirect or double reduction processes, in which the cost of the production of the aluminum is entirely dependent upon the cost of sodium and of the specially prepared salts of aluminum, all of which are expensive as compared with alumina.

The physical properties of aluminum are extremely interesting, as it differs so widely from all other metals; but so much has been written on this subject of late that it is not necessary to go into any extended detail here. In malleability and ductility, it ranks very high, being nearly equal to gold and silver. The cast metal has a hardness about equal to silver, but by hammering or cold rolling, on polished rolls, it becomes nearly as hard and elastic as "cold rolled" steel. As a conductor of heat and electricity, it also ranks very high, conducting heat better than silver and copper, and electricity nearly as well. The specific heat is also very high, as shown in the length of time required either to melt an ingot or for it to cool off after casting.

The fact of its being absolutely unaffected by wet or dry air, sulphur or sulphur vapors, commends its use in ornamental work, as it takes a polish equal to silver, and retains it under the most disadvantageous circumstances. The specific gravity varies between 2.58 in the cast metal and 2.68 when rolled or hammered. In tensile strength aluminum varies between 30,000 and 40,000 pounds per



The Hall Aluminum Process.

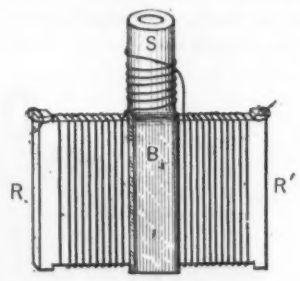
square inch, while when alloyed with copper to form aluminum bronze, the tensile strength runs up from 60,000 pounds to 110,000 pounds per square inch.

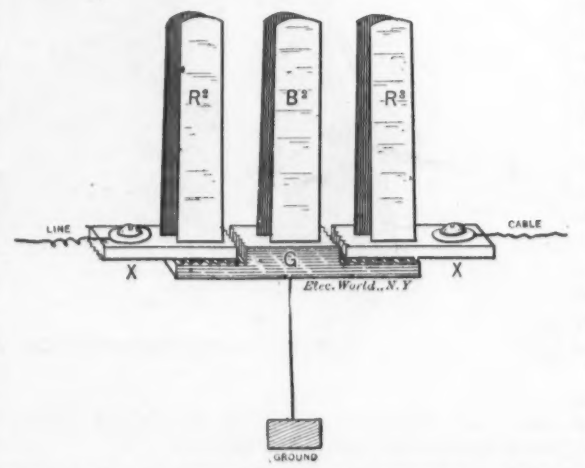
"Jump" Lightning Arrester with Fuse Wire.

by W. W. L.

I have read with interest an article by Mr. A. R. Bennett, from the *London Electrician*, and reprinted in The Electrical World of Sept. 7, on the use of a fuse wire in connection with a "jump" lightning arrester. The idea may be entirely new to Mr. Bennett, but the Pennsylvania Telephone Company has had an arrester constructed on this principle in use for nearly two years. It was introduced by their late General Manager, Mr. J. B. Ker, and I understand is extensively used in England.

It is a simple arrangement, as may perhaps be seen from the accompanying sketch. It is composed of two main





Figs. 1 and 2.—A Form of "Jump" Lightning Arrester.

parts, the stem, Fig. 1, and clips, Fig. 2. The stem *S B*, is of brass tubing, which is flattened for the greater part of its length, which entirely surrounds a thin piece of hard rubber *R R*, in the centre. A piece of No. 30 magnet wire is then bared at each end, leaving from six to eight inches in the middle insulated; the bared ends, which should be from eight to twelve inches long, are wound over the rubber laterally on each side of the brass. The covered middle of the wire is wound on the brass *S*.

The clip. Fig. 2, is a set of three double springs R^2, B^2, and R^2; they are fastened to plates *X X*, the middle one going to ground, the others to line and cable respectively. The plates are serrated on the edges exposed to each other; and grooved or corrugated on the greater surfaces exposed, the plates *X X* being grooved on the under side longitudinally, and the plate *G* laterally; the plates *X X* are separated from *G* by thin sheets of mica. The action is obvious. The stem, Fig. 1, is slipped into the clip springs, Fig. 2. A very light charge of lightning will burn the insulated wire at *S*, while a little more will fuse it, leaving the line open; then heavier charges will jump from the plates *X X* to *G*, either across the serrated edges or perforating the mica through the corrugations, which, being at right angles to each other, expose a number of points for action.

This is a sure protection, the stems being easily rewound, and you can always have a few extra ones in readiness for instant change. By using a still finer wire it becomes a very good protection against electric light or other heavy currents.

An Argument Against Electrical Execution.

In a paper read before the American Social Science Association at Saratoga, Dr. Peterson says:

The most cogent argument that I can urge against electricity as a death penalty is the complexity of apparatus required, in comparison to the simple instruments for hanging or beheading. The dynamo must be in good order; the machinery, the running gear, must be carefully adjusted; the wires perfectly insulated and guarded from unwary spectators; the electrodes in perfect juxtaposition; the skin and poles well moistened; the prisoner securely bound; the electromotive force determined to be adequate; the continuity of the circuit ascertained to be unbroken; the contact made for the requisite period of time by a firm, trained hand.

Then, after all has been superintended with extraordinary care by one or two expert electricians, how easily could some part become disarranged and the prisoner made to endure an eternity of delay upon the brink of death, or caused to suffer some physical torture a trifle less exquisite.

Suppose that all is in complete readiness, the contact is made, the victim instantly becomes unconscious and rigid; he has ceased to breathe; his ventricles beat no longer. But if a break should occur after the first two or three seconds, would life always be so soon extinguished? Probably not. Hence for from fifteen to twenty seconds the current must be made to flow, until re-awakening is placed beyond all further possibilities.

Now, this is not the ideal method that arose in the imaginations of the founders and projectors of this law. This is not the thunderbolt falling unexpectedly and suddenly, with a speed swifter than light, severing in a fraction of a second the vital force that holds conscious spirit and unconscious clay together.

A New Electric Exploder.

With the view of avoiding accidents from explosion and shot-firing in mines, Messrs. Maret Bros., France, have brought out an apparatus for the firing of shots by means of electricity. These gentlemen have arrived at the same conclusion as a Government Committee, viz., that all kinds of ordinary fuses and high tension electric apparatus, such as induction coils, etc., which are liable to give off sparks on account of the high voltage, should be absolutely excluded. Their apparatus consists of a low tension dynamo, which immediateiy transforms mechanical inertia into electric energy. An electric bell is employed to determine the condition of the circuit and primary. This machine, which weighs but 22½ pounds, it is claimed, will heat to redness a platinum wire 1 metre long, which would take a battery power of from 60 to 70 Leclanché cells. The great energy of this exploder allows of the platinum fuses being stronger, larger and more regular, and from 1 to 80 fuses can be simultaneously fired, depending on the length of the circuit, and with ordinary conductors, having an E. M. F. of 100 volts, whereas with static machines, a much higher voltage would be required. In an experiment with this apparatus before the Société d'Encouragement, a 12-centimetre wire was placed at the end of a cable having a resistance of 20 ohms, and was heated to redness, 1 metre of the cable being stripped of insulation and put in water, the 12-centimetre wire being placed at the end. This is considered a very satisfactory result.

Dynamo Construction.

To the Editors of The Electrical World:

Please answer these two questions: (1) What resistance must I use to allow one-quarter ampère to flow at 500 volts? (2). What is the smallest size of wire I can use for this and not heat the magnets? P. F. J.

Port Huron, Mich.

Answer.—(1). The required resistance to allow a given current at a given E. M. F. is found from Ohm's law

$$R = \frac{E}{C}$$

Where R = required resistance.
E = given E. M. F.
C = given current.

Which in this case is

$$R = \frac{500}{.25}$$

$$R = 2000\omega$$

(2). A good practical rule is an allowance of 700 to 800 circular mils per ampère, which gives 27 or 28 B. & S. gauge.—Eds. E. W.

The New Telemeter System.

This system of electrically transmitting to any distance, temperature, steam or water pressure, height of water or other liquids, height of gas holders, barometric changes, etc., etc., and recording them on a printed time chart, which has long been in practical operation, has recently been brought to a state of perfection that insures for it a great technical and commercial value. Many of its uses cannot be reached in any other known way. A brief detailed description will enable our readers to form some idea of the many uses to which it can be adapted.

For the purpose of transmitting the various indications and changes, two or more instruments are required, one for transmitting and one or more, as desired, for receiving; a single transmitter being sufficient to transmit its indications to any number of distant points, and record the changes on one or all of the receiving instruments. The receivers are connected by wires to the transmitter in multiple arc; one of the receivers having a circuit breaker to break the circuit after each impulse has been sent by the transmitter. The circuit is supplied by open circuit batteries placed near the circuit-breaking receivers.

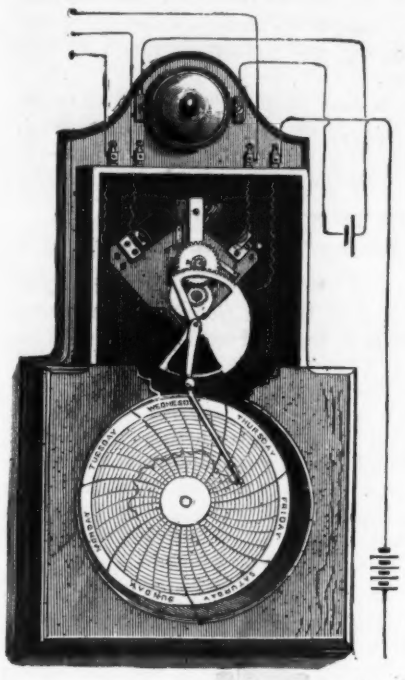
The instruments are simple and compact in construction. The different parts and electrical connections are easily traced out by all having even a limited knowledge of electrical mechanism, are not liable to get out of order, and are as easily taken care of as an ordinary clock. The transmitting mechanism is substantially the same in all cases, and the receivers are counterparts of the transmitters. Where a record is required, an eight-day clock carrying a printed time chart (daily or weekly) is placed in the lower part of the receiver case; a pen, carried by an arm connected to the electrical mechanism, traces in ink upon the chart a clear record of the changes as they are transmitted. The receiver is also provided on its indicating dial with adjustable contact hands to give an alarm when the desired maximum and minimum indication is reached.

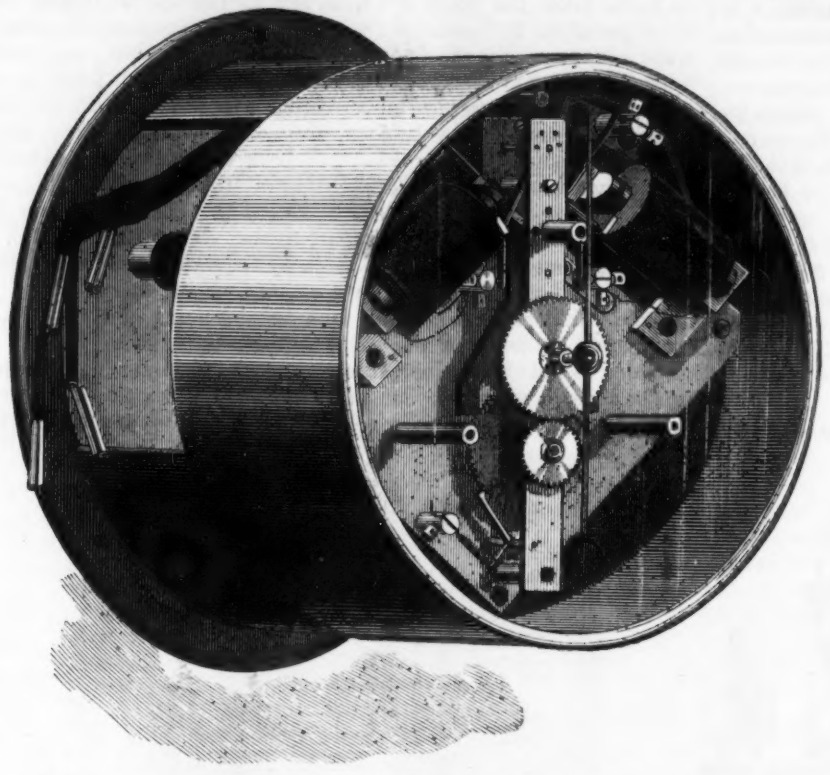
A tele-thermometer transmitter with the dial removed is represented in Fig. 1; all the mechanism except a simple commutator is here shown, with the electrical connections. The thermometer, pressure gauge, or other instrument whose indications it is required to transmit, is placed back of the transmitting mechanism in such relation to the latter that the movement of its hand will make a contact with the commutator. All the instruments have the same step-by-step motion, with a driving wheel acted upon by a pair of pallets, formed from one piece of metal, and driven by two pairs of electro-magnets, one for turning the driving wheel in one direction, and the other for turning it in the opposite direction. The motion is conveyed to a central index arbor by a single pair of gears. The parts are uniform and interchangeable from one instrument to another. The difference in the mechanism between the transmitter and receiver is very slight, as will be seen by reference to Fig. 3, and will be appreciated by electricians and mechanics generally.

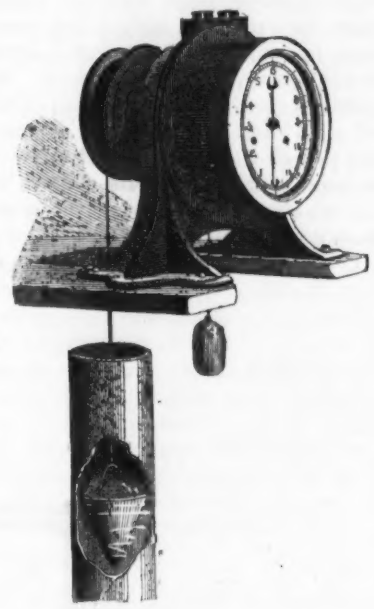
The receiver, with the indicating dial, removed is shown in Fig. 2. The connecting wires are easily traced, and the recording mechanism clearly defined. A toothed sector, to which the arm carrying the recording pin is fastened, is attached to an arbor pivoted in the frame of the instrument; this sector is made to be engaged by a pinion on the index arbor, so that any movement of the indicating hand in either direction is communicated to the recording pen and traced on the time chart. The circuits are shown diagramatically in Fig. 3.

The parts are as follows: *a*, hand carried by thermometer and electrically connected to base of transmitter giving the initial contact; *a' a'*, contact points and metallic strips separated by insulating material forming the commutator; a^1 a^2 wires connecting commutator strip *a'* to screw 2 and magnet *M* 2 and strip *a''* to screw 1 and magnet *M* 1; 1, 2, posts and screw insulated from base of the transmitter; 3, 4, contact springs fastened to initial armature; 5, 6, light armatures connected together and pivoted between the plates of the transmitter, normally held in position by springs, not shown on the face of the armatures, and bearing on the face of the cores of their respective magnets, electrically connected with the base of the transmitter; 7, 8, contact posts and screws insulated from the base of the transmitter; 9, 10, contact springs fastened to the driving armatures electrically connected to the base of the transmitter; 11, 12, armatures screwed to a lever, centrally pivoted between the plates of the instruments, and carrying a fork or pallet for driving the mechanism of the instruments; 13, circuit-breaking lever pivoted between the plates of the receiver, and electrically connected thereto; 14, spring of the circuit breaker, insulated from the base of the receiver, and connected by wire to one pole of the battery *B*; 15, lever centrally pivoted between the plates of the receiver to hold the forks or pallets in a central position when acted upon by movement of the forks to strike the lever 13, throwing the lever from the spring 14, thereby breaking the circuit; 16, pawl for holding the driving wheel *W* in its normal position; 17, 18, pins in the fork to act upon the inclines of the lever 15; *W*, driving-wheel pivoted between the plates and used in all instruments; *L* 1, line connecting magnets *M* 1 and *M* 2 of the transmitter to the base of the receiver; *L* 2, line connecting insulated post 7 of transmitter with magnets *M* 3 of the receiver; *L* 3, line connecting insulated post 8 of the transmitter with magnet *M* 4 of the receiver; 4 *B*, line connecting the base of the transmitter with one pole of the battery *B*; *M* 5, *M* 6, magnets of the intermediate receiver connected to lines connected with corresponding magnets of the receiver.

The action is as follows: The hand *a*, which is always in contact with the battery, move-







FIGS. 2, 1 AND 6.—THE IMPROVED TELEMETER SYSTEM.

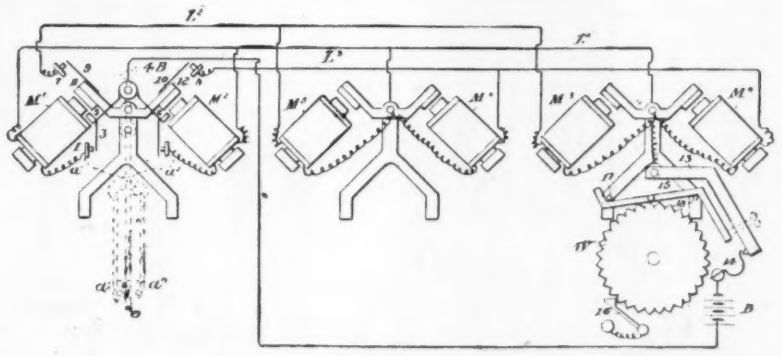
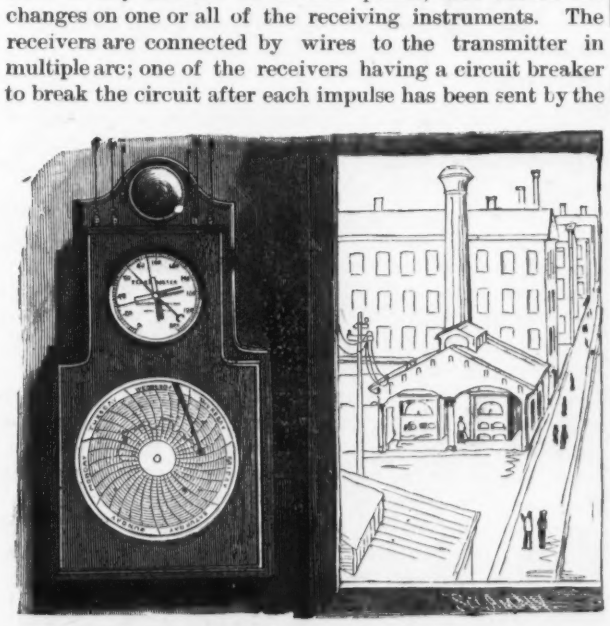
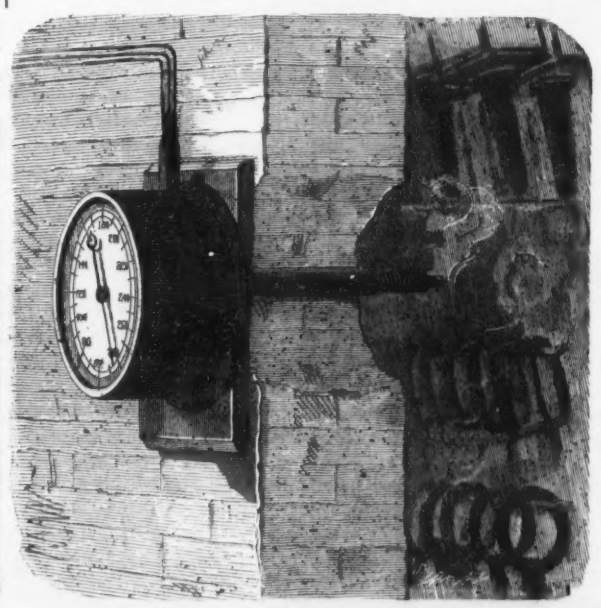
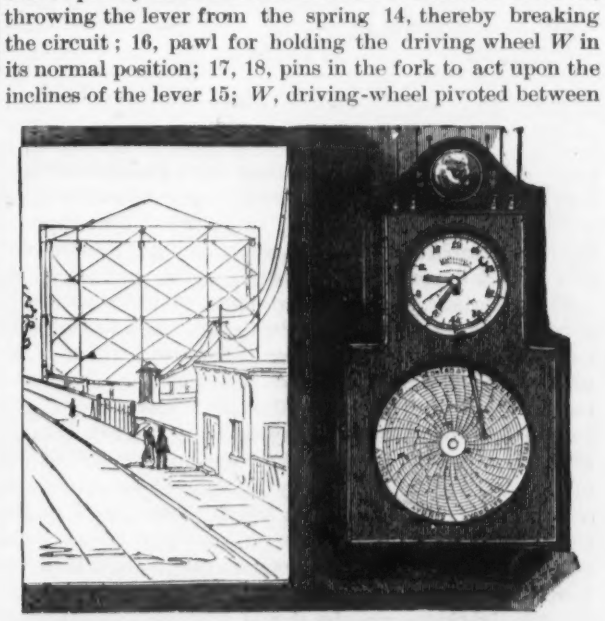


FIG. 3.—DIAGRAM OF CIRCUITS.







FIGS. 4, 5 AND 7.—DETAILS OF IMPROVED TELEMETER SYSTEM.

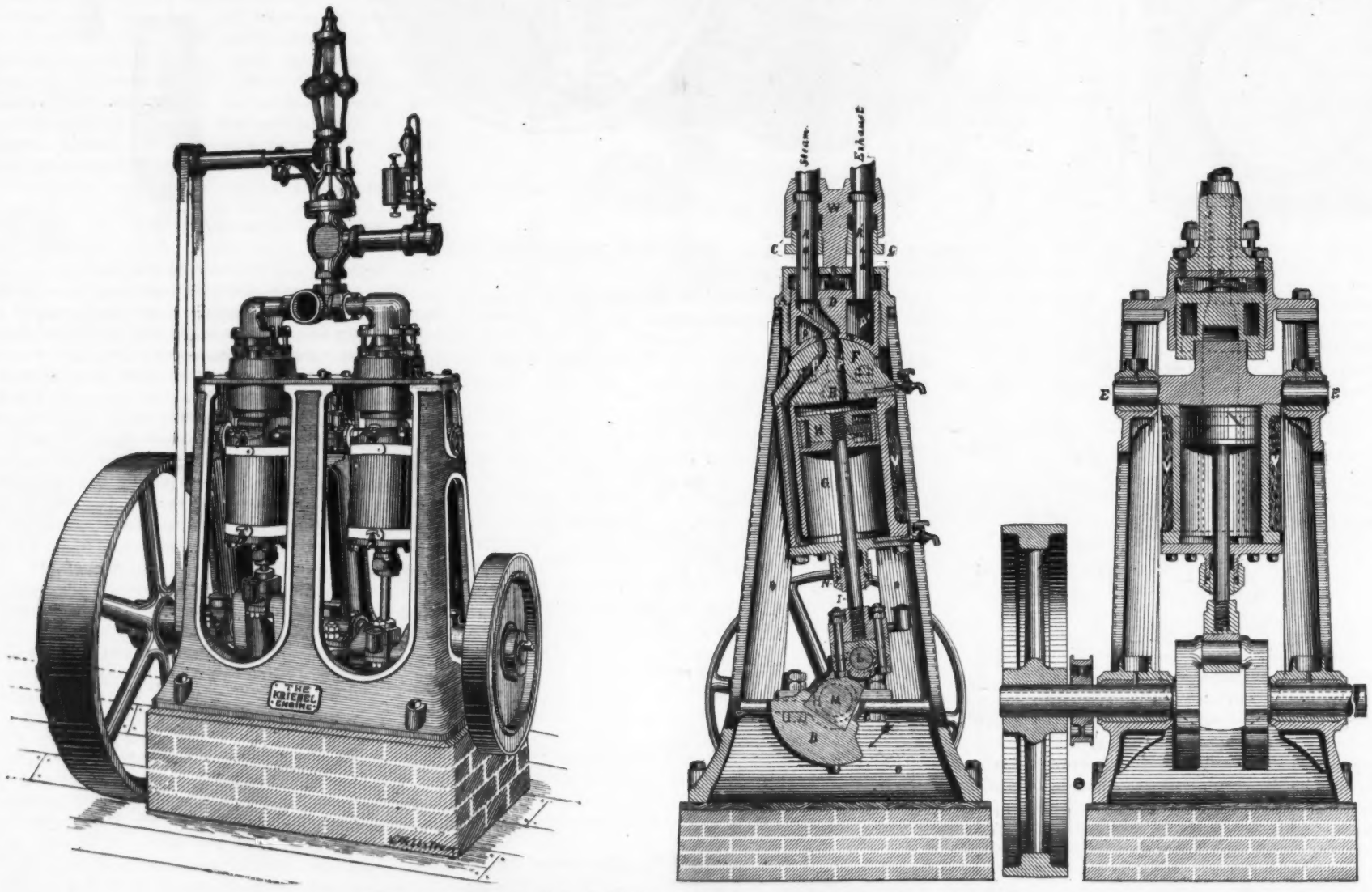
and makes a contact with the commutator point a' and closes the circuit; the current passes through the line 4 B, thermometer b and a, commutator a', wire a, and magnet M 1, then from the transmitter through line L 1, to the base of the receiver; from there through lever 13 and spring 14 to the battery. The light armature 5 will be attracted by a feeble current, bringing the spring 3 in contact with screw[1], shunting the commutator, which will be moved away from its contact with the hand, by the mechanism of the instrument. The armature 11, attracted by magnet M 1, brings the spring 9 in contact with the screw 7, dividing the current which passes through the line L 2, magnets M 5, of the intermediate receiver, M 3, of the receiver, to the base of both instruments, through the lever 13 and spring 14 to the battery. The armature of the magnet M 3 is attracted, carrying the fork or pallets which propel the wheel W, and also by means of the pin 18, pushes lever 15, so that it strikes the adjustable screw in lever 13, throwing it away from its contact with spring 14, breaking the circuit and allowing the instruments to return to their normal position.

One of the applications to which the system has been adapted is that of transmitting time from a master clock to a series of dials. As a time system it has proved accurate and reliable, and recommends itself to electrical dealers as an easily obtainable electric time system. In Fig. 4 is shown one of the most important applications of the system, of especial importance to all steam plants. The transmitting steam gauge on the boiler in the distant boiler room is connected by wire to the receiving instrument, where it indicates the boiler pressure, and also makes a continuous record, clearly defined and easily read. The receiver can be placed in the office, or at any desired point, at a distance away from the transmitter, where the records will be out of all danger of destruction by an explosion, should one occur. Intermediate receivers can be placed in the engine room, or wherever the boiler pressure is required to be known. The indications of pressure can be read from the transmitter at the boiler the same as any steam gauge. Electric lighting companies should find this instrument of great advantage, as it enables the management to see how the steam pressure in their boilers has been kept up during the night.

In Fig. 5 is shown the application of the tele-thermometer to a japanning oven. The thermometer spiral extends into the kiln, and its shaft passes through a tube to the transmitting instrument attached to the outer surface of the oven wall. This tele-thermometer with ordinary pipe fittings can be attached to any boiler, tank or pipe, to show the temperature of the liquid, gas or steam contained therein; they are made in various lengths. Wires leading out of the top of the instrument lead to the receiver at a distant station. Many other situations for the tele-thermometer suggest themselves, such as in mines and similar places.

In Fig. 6 is represented a water level indicator capable of giving the height of water in reservoirs, dams and streams, and showing the rise and fall of tides. It is also used for oil tanks and other liquids in boilers, open or closed, or under pressure. A similar application of this same instrument is shown in Fig. 7, where the drum of a gas holder takes the place of a float, and the rise and fall of the gas holder is transmitted to the recording receiver in the office, from the record of which the cubical contents of the holder can at any time be determined.

It is obvious that there are numerous other uses to which these instruments can be applied, for commercial and scientific purposes. They will prove of great value in connection with meteorological instruments, transmitting dynamometers, speed indicators or to record the changes of ground temperatures at different depths; changes as close as $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{10}$ degree Fahrenheit may be shown and recorded. They may also be employed as deep sea thermometers and pressure guages, and for indicating the temperature of the sea in the track of sea-going vessels, keeping a record of the temperature during their voyage. This has been demonstrated on one of the best government survey steamers, and some very interesting records of the temperature of the sea have been taken. These instruments are manufactured by the Standard Thermometer Company, Peabody, Mass.



FIGS. 1 AND 2.—THE KRIEBEL ENGINE FOR ELECTRIC LIGHTING.

The Kriebel Duplex Engine for Electric Lighting.

To meet the demand for a vertical duplex stationary engine of small power, having few working parts, simply and compactly built, that will be serviceable for economically operating electric light dynamos, the Rice & Whitacre Manufacturing Company, Chicago, are manufacturing to order, under the Kriebel patents, the engine we illustrate on this page. As shown in both sectional and front view, Figs. 1 and 2, the two cylinders placed within one frame are moving or vibrating cylinders with stationary valves, in place of the ordinary stationary cylinder and moving valve, This permits of several parts found in ordinary slide-valve engines being dispensed with. The engine frame OO is made in one piece and has boxes on each side to receive the crank shaft M and the solid trunnions E, which project at right angles from the upper head of the cylinder, and on which the cylinder is supported and pivoted. The piston H is connected by the piston rod I to the crank pin L, and the three are always in a straight line, consequently, as the piston moves up and down, the cylinder vibrates back and forth on the trunnions.

The valve D is a hollow, cylindrical casting, inclosed in a casing A attached to the engine frame. The bottom of the valve has a smooth *concave* surface, while the upper end of the cylinder F has a smooth *convex* surface. The two surfaces make a perfect joint, and any wear that occurs is automatically taken up by springs U coiled around bosses above the valve.

The steam and exhaust pipes S and T connect with two brass tubes, R and R^1, which are screwed into the valve and communicate with the valve ports X and QQ^1. There are two cylinder ports, P and P^1, which open into the top and bottom of the cylinder. As the cylinder vibrates back and forth on the trunnions, the cylinder ports alternately take steam from the central valve port X and exhaust through the ports Q and Q^1. In our marine or reversing engines, the direction of the steam in the tubes can be changed so that the cylinder ports will either take steam from the port X and exhaust through the ports Q and Q^1, as above, or else take steam from Q and Q^1 and exhaust through X, and thus reverse the engine.

The piston-rod has a long stuffing-box N. The upper ends of the tubes, R and R^1, are received by fixed stuffing-boxes C. B represents a counter-balance, which is bolted to the cranks of engines with 5 × 6-inch cylinder and upward.

The Edison Filament Patent in Canada.

In regard to the visit of Mr. Edison to London, the London correspondent of the Boston *Herald* writes under date of Sept. 7: "Frank R. Upton, President of the Edison Electric Lamp Company at East Newark, and Eugene H. Lewis, of New York, who were with the Edison party in Paris, arrived in London this week, and Upton sailed for America on the Saale Thursday. Lewis, who is Edison's lawyer, and has conducted most of his recent patent suits, remains here to meet Edison and Evarts, a circumstance showing that Edison has changed his plans, and will come to London, and that he is to be accompanied by Mr. Evarts, whose ostensible purpose in visiting Paris was to have his eyes treated by an eminent French oculist. This gives rise to a rumor affecting electric lighting interests in America. The rumor is that Edison and the two lawyers visit London for the purpose of having a consultation with her majesty's ministers about the prospect of Canada's being included in the patent convention of 1883, which governs the patent laws of the United States and Great Britain, with a view to its effect upon Edison's high resistance filament patent now in litigation in Canada. England reserves the right by the terms of this convention to include any of her colonies under its provisions, and the clause that is supposed to interest the Edison people provides that the importation of a patented article from one of the States bound by the convention to another shall not invalidate the patent. The filament patent was first taken out in Canada, and according to Canadian law, an article patented in that country and manufactured in another country cannot be imported into Canada without invalidating the patent. Whether the Edison filament patent has been thus invalidated is now being considered in the Canadian courts, and the representatives of other American electric lighting companies, who will be affected by the decision, believe that an effort is to be made to bring Canada into the convention that binds Great Britain [illegible]

order to take advantage of the clause giving the right of importation between the states bound by convention. This would, at least, give an opportunity to gain time by bringing an intricate legal question into the courts. Lewis professes utter ignorance of any such move on the part of Edison and Evarts, however."

The "Unique" Electric Alarm Clock.

To be awakened at a seasonable hour in the morning is a matter of much importance to thousands of employés, many of whom are on their feet till a late hour at night and therefore inclined to sleep the more soundly, yet who often lose refreshing sleep through worrying over the possible loss that will result should they report late at work. The ordinary alarm clock will awaken a sound sleeper on a few occasions, but the service is lost unless the person awakened immediately arises, as the continuance of the noise is of such slight duration that otherwise he falls asleep the moment the alarm stops.

Thus it has been found necessary to devise an alarm that would continue ringing until the person awakened should arise, and, by moving some simple device, stop the noise, the very act of rising being sufficient to thoroughly awaken the sleeper. This is easily accomplished with the aid of electricity, and various alarm clocks have been placed on the market containing electrical features of more or less importance. One of the latest is the "Unique" alarm clock. As shown in the illustration, it consists of a special clock placed in a case made according to the pattern shown. Within a lower compartment a battery is placed, above which is a vibrating bell. The necessary connections are made between the clock, battery, bell and switch by means of round and flat wire fastened to the side of the case and on the door. The clock is made with an automatic spring circuit closer, and once in every twelve hours exerts a forward pressure which is made to close the circuit by pressing together the two strips of copper placed near the top of the door, and to keep the circuit closed for several hours, causing the bell to vibrate until the switch on the side of the case is turned off, or the mechanism of the clock passes a given point and releases the spring.

This alarm clock is manufactured by the Darche Electric Company, Chicago, who control all the patents relating thereto, and who claim that being simple and compact it cannot get out of order, that it is practical in every sense of the word, possessing the great merits of not having the steel parts of the clock affected by magnetism, as no current passes through, or in any way comes in contact with the clock, and that the point of contact cannot become corroded, as no occasion will arise where handling of the same will be necessary.

The Electric Transfer Table at Fitchburg, Mass.

The accompanying cut, for which we are indebted to *Science*, represents the new transfer table at the Fitchburg car repair shops at Fitchburg, Mass., just built by the Fitchburg Railroad Company. The table or car is moved by the Union Electric Car Company's system. The motor, gears, clutches, etc., are all on the front axle of the car. The motor is geared to the axle, and the gears run in an enclosed bath of oil. They are brass cut gears, and work with the least possible amount of friction and consequent loss of power. The switch which governs the motor and controls the car is just above the motor, on a platform built out from the front of the car, as are also the reversing bar and the handle throwing in and out the clutch by which the motor is used either to propel the car in the desired direction or to draw off and on the cars to be changed from one track to another.

The two shops are each five hundred feet long, and face each other. Each shop is divided into three divisions, separated by brick walls running through the roof. In each division there are eight tracks, making twenty-four in each shop. Between these shops, which are seventy-five feet apart, is the pit in which the table or car moves. The car is ten feet long and seventy feet wide, and runs on four rails laid in the pit. The track on the car, running from side to side, matches the tracks in the shops. The control of the table is so perfect, by the use of the switch that it can be put and matched to any track desired without the least trouble or hitch; the same power that moved the car forward stops or slows it. The table is run by the dynamo which lights the shops at night, and is connected by two overhead wires, on which run two trolleys, the trolley-poles being on the top of the house built over the front platform at the front of the table. Three men, one being at the dynamo, now run the table and draw on and off the cars, which work formerly required twelve men and a shifting locomotive and its men; and some four times the amount of work can be done by these three men.

Canadian Telegraphs.—The case of the Great Northwestern Telegraph Company against the Montreal Telegraph Company, is now being heard at Montreal before Justice Davidson, in the Superior Court.

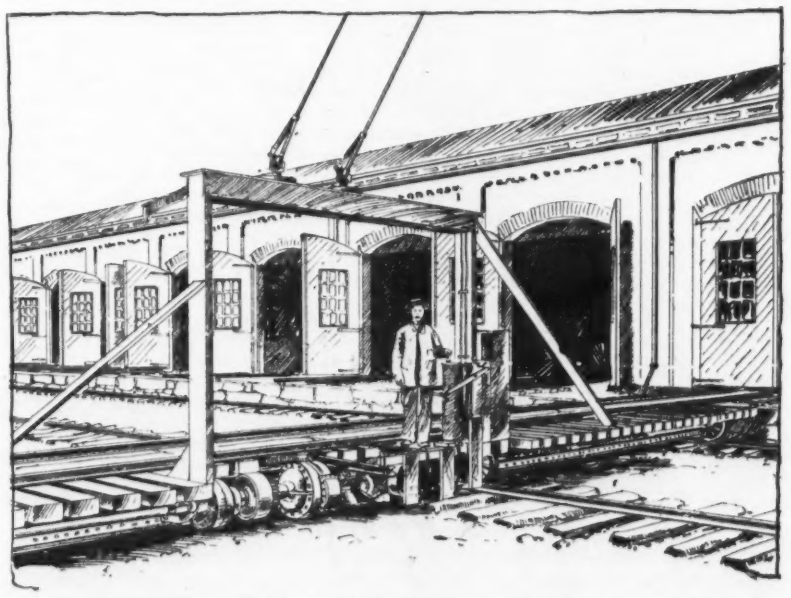
An Interesting Street Railway Motor Test at Asheville, N. C.

Quite an interesting test was made on one of the Sprague improved electric motors at Asheville, N. C., recently, and exhibits very clearly the power of these motors, as well as their high efficiency.

The Asheville Street Railway Company, who are now operating four cars on the Sprague system, recently purchased two of the Sprague improved motors for the equipment of the new street car which they had decided to add to their system. Although it was intended to equip the car with two motors, as the grades are quite steep, the question was raised as to what the results would be if only one motor was placed upon the car and obliged to do the whole work. In order to test this question, on August 6, the car, equipped with only one motor, was started over the line, and frequent readings of an ampère meter were taken in order to determine the power used on different portions of the line. At the same time that the ampère meter readings were taken, volt meter readings were taken, in order to make certain that the potential was maintained.

THE "UNIQUE" ELECTRIC ALARM CLOCK.

In all, three trips over 4,000 feet of the worst part of the line were made; twice with nine passengers on the car, in order to test the apparatus, and once with forty-three passengers. On the last trip the passengers were chosen from among the by-standers and the heaviest men were selected, so that the total weight of the car and load was certainly over 14,000 pounds. The difference in elevation in the distance of 4,000 feet was 185 feet. Upon the distance traversed were two reverse curves and three other curves, all of which were on grades, both reverse curves being on heavy grades with one radius of 50 feet. The curves were all dry and dusty. The length of wheel base was 9 feet, so that a large amount of power was required in going around the curves. Besides these and other difficulties, the journals of the car had not worn smooth, the car being entirely new, and it seemed very stiff, as it would not roll without being started on grades very much heavier than those on which the old cars habitually started by gravity.



ELECTRIC TRANSFER TABLE AT FITCHBURG, MASS.

During the entire run the freedom from sparking was perfect, and when the amount by which the capacity of the machine was exceeded is taken into account, this point was truly remarkable. The car ran at a speed of about nine miles an hour.

The amount of horse power required to raise the load against gravity alone for the distance attained is about 12 h. p., and adding the friction in the journals, on the track and elsewhere, the ampére readings showed that the motor, although working over 50 per cent. above its normal capacity, did the work at an extremely high efficiency. At the end of the three trips the motor, although warmer than one would like in everyday work, was by no means excessively hot, and showed no harmful results from the severity of the test.

The Affairs of Johns Hopkins University.

The interest taken by electricians in Johns Hopkins University is a keen one. This is natural, in view of the work done by the university in electrical research, under the direction of Prof. H. A. Rowland, a man of international reputation. We have much pleasure, therefore, in presenting the following statement from Baltimore as to the financial condition of the university.

"In view of the reports which have recently been published respecting the Johns Hopkins University, President Gilman authorizes the statement that the university will begin its new year on the 1st of October with unimpaired efficiency. Neither the salaries of the president nor those of the professors have been cut, and several new appointments have been made. The indications point to the usual number of students, and the course of instruction will be given as announced in the programme.

"As to the finances of the university, it is no secret that the income derived from the Baltimore & Ohio Railroad was cut off some time ago. But the accumulated income of former years, the income from investments outside of the railroad, the income from tuition (which last year amounted to nearly $40,000) are available. Besides all this, persons have subscribed the sum of $108,000 to be expended as an emergency fund during the next three years. It is safe to say that within six months the Johns Hopkins University has received from various sources nearly $300,000. The national character of the institution is a strong reason why its work should receive important aid from a distance. It would thus be seen that no consideration need be given to alarming rumors, as the present efficiency of the university is assured for the next three years."

The Difference Between Primary and Storage Cells

To the Editors of The Electrical World:

In your last issue David Flanery wishes to know the difference between a primary and a storage cell.

A storage cell, before it is charged, is *no battery at all*, as you have *similar* metals immersed in one fluid which does not generate any current under any circumstances. When, however, a thin wall is subjected to a strong current, both plates are electrolyzed, one receiving a coating of spongy lead and the other of sulphate of lead. Now, you have two dissimilar forms of metals and chemical action can take place to destroy them. So long as these dissimilar forms of metals remain, so long we have a current. When in operation, the action is primary, but when not subjected to a current the storage cell is *no battery at all*.

GEORGE TREBEL, M. D.
HAMILTON, O.

About Search Lights.

To the Editors of The Electrical World:

Will you please answer through the columns of your paper, or tell me of some back number, that will answer the following questions:

1. What is a search light, such as used on vessels?

2. What is a revolving search light, such as used on the Eiffel Tower, Paris Exposition?

You will greatly oblige a beginner.

HARTFORD, Mich. W. B. N.

ANSWER.—1. A search light consists of a powerful arc light and reflector, whose rays can be projected in any direction to illuminate any desired area or object, and is principally used on shipboard. These lights are operated frequently aboard the men-of-war exercising at Newport, R. I., and can be seen on many Western waters. 2. A revolving search light is one capable of rotation about its axis, the one on the Eiffel Tower being manipulated at will, so as to throw its beam over any part of Paris.—EDS. E. W.

Converters and Motors.

To the Editors of The Electrical World:

Will you please answer the following questions in THE ELECTRICAL WORLD: (1) What is the formula for finding the amount of wire in the primary and secondary coil of an induction coil, and the amount of iron? Example, how much wire must be used to raise 10 volts to 50 volts and how much iron? (2) Can I make the constant current regular for motors described on page 42 of THE ELECTRICAL WORLD of Jan. 26, 1889, without infringing?

A SUBSCRIBER.
ST. LOUIS.

ANSWER.—(1) We would refer you to "The Practical Construction of Transformers," by Mr. W. Forman Collins, on page 164 of the issue of Sept. 7, 1889.

(2) We presume you could use the method, if it is not patented, but are inclined to think that it is, and is the property of the Baxter Electric Manufacturing and Motor Company, of Baltimore, Md.—EDS. E. W.

The Heavy Equinoctical Storms of the past week have played havoc with the overhead wires in all parts of the country visited. In New York City a great many wires were brought down or crossed. All along the Jersey and Long Island coast, and northward to Boston, the service was seriously interrupted. At Coney Island the Commercial Cable hut had a narrow escape from being washed away.

The International Electrical Conference at Paris.

(From Our Special Correspondent.)

Proceedings of Section I.—*Units and Measures.*

Paris, France, Aug. 27, 1889.—The meeting was opened by M. Van Aubel, who presented to the Congress the bismuth spirals of Lenard and Howard, and the apparatus of Prof. Ångström for the measurement of the intensity of magnetic fields. He determined that the relation between the intensity of the magnetic field and the electric resistance is unknown, because we can neither employ the formula of Leduc nor the laws of Righi and Goldhammer. A calibration of each spiral is thus necessary. He also demonstrated that the spirals of Lenard and Howard could nevertheless be employed for industrial purposes, and especially in the case of strong concentrated fields. He described also Angstrom's apparatus, and recommended the methods of Professors Stenger and Angstrom, which give a precision much greater than the others.

M. Szarvady took up the question of practical units which had been adopted by the Congress of 1881, and referred to the fact that they had not established a practical unit for the magnetic field. This required attention at the present time. It had been proposed to define a unit magnetic field as that of a uniform field which would produce an electro-motive force of 1 volt in a conductor 1 centimetre long cutting at right angles the lines of force at a speed of 1 centimetre per second ($E = H\,L\,V$). This unit would be equal to 10^8 C. G. S. units. The usual strength of magnetic fields being taken as between 100 and 15,000 C. G. S. units, the unit proposed would be too great, and the unit usually employed would be a sub-multiple $\frac{1}{10^6}$ or the *micro*, a practical unit which would be equal to 10^2 C. G. S. units. A choice of a practical unit field embraced also the practical unit of flux of force $H\,S$ $\left(E = \frac{H\,S}{T}\right)$, which would be equal to 10^8 C. G. S. units. Here also the usual unit would be the sub multiple $\frac{1}{10^6}$ of the unit. Whatever be the unit adopted it was necessary to give it a name. He proposed the following: *Gauss* for the unit intensity of field, and *Weber* for the unit flux of force.

M. Curie observed that the system was not coherent.

M. Guillaume spoke of the necessity of adopting a practical unit of pressure. The theoretical unit is $\frac{\text{the dyne}}{c\,m^2}$, for which is substituted $\frac{\text{the megadyne}}{c\,m^2}$. The pressure exerted by a column of mercury of 1 centimetre height at 0 degrees C., in latitude 45 degrees at the sea level is, according to the best measurements, $15.5956 \times 980.63 = 13{,}322.25$ degrees.

The $\frac{\text{megadyne}}{c\,m^2}$ is thus determined in the same way to be a column of mercury 75.006 cm. high. The error in this figure being about $\frac{1}{10{,}000}$, there is no departure from the limits allowed, in adopting as a practical unit the pressure exerted by a column of mercury 75 centimeters high. M. Guillaume proposed for this unit the name *barie*.

M. Guillaume also presented some considerations on uniformity of notation. He recalled the decisions taken by the International Committee on Weights and Measures for the metric units, and proposed to adopt an analogous system for the mechanical and electrical units. The system consists in designating each of the units dyne, erg, barie, watt, volt, ampère, farad, coulomb and joule by two initials in Roman characters; the ohm would be designated by ω; the usual multiples and submultiples would be the following: mega *M*, kilo *k*, milli *m* and micro μ.

The President expressed the desire that all possible publicity would be given to the abbreviations adopted by the International Bureau of Weights and Measures.

Dr. Moser, of Vienna, proposed the adoption under the name of *trop*, or any other desirable term, of a unit of entropy defined by the formula: 1 joule = 1 trop × 1 degree centigrade, analagous to the equation: 1 joule = 1 coulomb × 1 volt.

The President remarked that the centigrade degree was not an absolute unit.

M. Violle proposed that the candle employed in electric light measurement as a standard be taken as equal to one-twentieth of the absolute unit of light adopted by the International Congress of 1884. This candle being very nearly equal to that usually employed, and almost equal to one-tenth of a carcel, should be named the *decimal-candle*.

M. Hospitalier proposed to add to the electrical units already adopted independent of the watt and joule, a unit of specific resistance and a unit for the coefficient of self-induction. This proposition was referred to the Committee on Units.

The first and the second section have nominated the following members as the Committee on Units: Benoit, Roiti, Zilow, Webber, Curie, Guillaume, Moser, Gerard, Fontaine, Hospitalier, Picou, Napoli, Rousseau, Ferraris, Boistel, Preece, Crompton, Carpentier, De Nerville.

M. Zenger offered a communication on bipolar induction in a rotating sphere, and described an apparatus which permitted of the imitation of the movements of the planets in their orbits.

Proceedings of Section II.—*Industrial Application.*

The President opened the meeting by recalling that, at the end of M. Crova's communication on the photometry of incandescent lamps, read the day before, it had been decided that a special commission should examine the different propositions. A meeting had been held and had adopted the following resolution: *The degree of incandescence of the lamp is the quotient of the intensities (relative to the carcel) of the radiations of the wave length* $\lambda = 582$, *and the radiations of the wave length* $\lambda = 657$.

In order to determine it, the lamp is compared with a carcel, and there is placed before the eye a vessel filled to a thickness of five millimeters, with a solution of chlorides of nickel and iron, which allows rays of light to pass having a wave length of about $\lambda = 582$; let a be the the intensity of the lamp under these conditions. The same measurement is then made by placing before the eye a red glass which allows light to pass having a wave length of about $\lambda = 657$; let b be the intensity of the lamp under these new conditions. The proportion $\frac{a}{b}$ is the degree of incandescence.

The wish was expressed that when indicating the illuminating power of a lamp it be accompanied by that of the degree of incandescence to which that illumination corresponds.

The committee also expressed the wish that if the power be given in candles, it be done in decimal-candles* equal to about $\frac{1}{10}$ of the absolute standard of light as defined by the Congress of 1881. These ideas were unanimously adopted.

At the suggestion of M. Fontaine, M. Crova recapitulated the principal points of the method as proposed by him. He gave the composition of the solution which gives the wave length 582. He takes 22.321 grammes of per-chloride of iron and 27.191 grammes of pure crystalized chloride of nickel. The whole is dissolved in distilled water at 15 degrees C. It is necessary to be careful not to filter the solution, and to saturate it with chlorine in order to make the solution keep. The second part of the experiment is made by means of a red glass which allows the wave length 657 to pass.

M. Mace de Lipenay added that he had found a relation between the total intensity of a luminous source and the photometric comparisons between the red and the green radiations. That relation is the following: $I = Aa + Bb$; I being the total intensity, A and B the intensities of the red and green rays, and a and b two coefficients to be determined by experiment. M. de Lepinay also remarked that he had been able to compare the red and green radiations by employing very fine black rods on a white background.

Professor Silvanus P. Thompson read a paper on continuous current transformers. After a short history of continuous current transformers he gave several formulæ relative to the operation of such apparatus.

Let e_1 and e_2 be the difference of potential at the primary and secondary circuits respectively.
ω_1 and ω_2 the angular velocities.
φ_1 and φ_2 the flux passing through the two circuits.
C_1 and C_2 the number of external primary and secondary circuits.
R_1 and R_2 the resistance of the armatures.
i_1 and i_2 the primary and secondary currents.
Then we have:

$$e_1 = E_2 - R_1\,i_1\,;\ e_2 = E_2 - R_2\,i_2.$$
$$E_1 = \omega_1 - C_1\,\varphi_1\,;\ E_2 = \omega_2\,C_2\,\varphi_2.$$

For a good machine, $\varphi_1 = \varphi_2$ and $\omega_1 = \omega_2$.

$$\frac{E_2}{E_1} = \frac{C_2}{C_1}.$$

Neglecting hysteresis, Foucault currents, etc., we have very nearly:

$$E_2\,i_2 = E_1\,i_1\,;\ \text{whence}\ \frac{E_2}{E_1} = \frac{C_2}{C_1} = \frac{i_1}{i_2}$$

And finally:

$$e_2 = e_1\,\frac{C_2}{C_1} - \left[R_2 + R_1\left(\frac{C_2}{C_1}\right)^2\right] i_2\,;$$

or,

$$e_2 = e_1\,\frac{C_2}{C_1} - \left[R_2 + R_1\left(I + \frac{P}{E_2\,i_2}\right)\left(\frac{C_2}{C_1}\right)^2\right];$$

P being the work lost in friction.

Professor Thompson remarked that continuous current transformers had already received a practical application at Ipswich. The difference of potential at the terminus of the primary circuit is 1,500 volts, and at the secondary 100 volts, and the present working would seem to indicate that it will rapidly receive considerable extension.

M. Maurice Leblanc then took up the subject of alternating current motors. He remarked that the alternating currents would have far more rapid extension if it were possible to obtain a practical alternating current motor. The ordinary alternating current machines, when employed as motors, required to be started in some way and to revolve in synchronism. The motors of Elihu Thomson and Tesla, though to be preferred in this respect, utilized the iron badly on account of the effects of self-induction. M. Leblanc reduces these bad effects in his system, which consists of a motor having an annular fixed armature, in the interior of which there revolves a Gramme ring, constituting the field magnets. The alternating current passes through this ring and is commutated by revolving brushes.

Mr. Gisbert Kapp considered on the contrary that the ordinary alternating current machines made satisfactory motors, which would only be in danger when the machine was given a current of three times its normal one. He cited an experiment made by Mordey with two dynamos without iron, of 50 h. p., turning at 600 revolutions per minute. The field magnets of the receiver were energized by accumulators until the machine had reached its normal speed, and then by a continuous current machine attached directly to the shaft of the motor.

Professor Forbes remarked that this manner of operation would not be possible in any extended system of distribution. Mr. Kapp also cited the experiments of Ferranti, who had run ordinary alternating machines without iron, and found that it was difficult to destroy the synchronism.

Proceedings of Section III.—*Telegraphy, Telephony and Signals*

The following communication was received by the section, "On the Utility of Finding a Recording Relay Sounder for Submarine Application."

M. Merczyng then read a communication "On a New System of Long Distance Telephony." This system has been invented by a Russian electrician, the author of the paper having limited himself merely to laboratory measurements and to some perfections in detail. The line experimented upon was 300 kilometres of iron wire of 5 millimetres diameter. The transmitters employed were of the Blake and Berliner types, the receivers of the Ochorowicz and Siemens types. The transmitters and receivers in this system are separated from the line by condensers of different capacity, this being the essential feature of the system. The capacity of the condenser-receiver ought always to be less than that of the condenser-transmitter. The line had a resistance of 2,000 ohms and a capacity of 3 microfarads. The condenser-transmitter had a capacity of 0.5 microfarad; the receiver, a capacity of 0.2 microfarad. These were found to be the best conditions; the receiver was very satisfactory. The work is not yet finished and hence more details cannot be given.

* This designation has been proposed by M. Picou.

M. Pierre Picard then read a paper entitled "On the Application of Dynamo Electrical Machines to Telegraphy." The discovery of the induced currents by the displacement of a coil in a magnetic field was applicable to telegraphy. There were two methods of applying this: The first system consists in combining the key and the induction generator in one. With this method the manipulation is awkward, jerky and very irregular; the system had therefore to be abandoned. A second system was offered by the discovery of the Gramme machine, in which the generator is entirely independent of the key. The difficulty in this system is to obtain the varying potentials according to the resistance of the line. Schwendler had tried to bring the potential at the beginning to the same value for all lines by means of additional resistances; thus for the short lines resistances had to be added which were greater than that of the line itself. The trials made in 1879 on eleven circuits had to be abandoned. At New York the installation consists of three series of five dynamos; in each the fifth dynamo serves as the exciter of the four others; one of the series serves for the positive currents, the other for the negative. Each dynamo has a potential of 75 volts, and there are thus available initial potentials of 75, 150, 225 or 300 volts.

The author has sought to obtain a third system, in which a single dynamo can be combined with apparatus for taking currents at various potentials. He accomplishes this by putting one of the poles of the machine to earth directly and the other across a resistance which he calls a "scale of potentials." According to the position of the contact on the scale the potential will be greater or less. In order to avoid dangerous short circuits on each of these derivations there is inserted a resistance of 4 ohms per volt. Very conclusive trials have been made at Paris during the last twelve months. The scale of potentials has a resistance of between 5 and 6 ohms; the current passing through it is between 15 and 20 ampères. The economy of the system was found to be considerable. There can be obtained, as desired, positive or negative currents by putting the two poles to earth across the scale of potentials.

Mr. Georges d'Infreville, of New York, remarked that the system described by M. Picard as being employed in New York, was that formerly used by the Western Union Telegraph Company. The machines were Siemens' dynamos, which ran for eight years. They occupied only a very limited space, and having become insufficient for the service, they were transferred to Pittsburgh, The same system is also employed at Albany. At New York there are now employed Edison machines and the original system has been combined with the "scale of potentials" system. The 16,000 elements formerly in use were displaced, but batteries are still used for the sounders. An experience of eight years has demonstrated a considerable economy for the system. Mr. d'Infreville remarked that the system described by M. Picard was patented in the United States and employed on a large scale by the Gold & Stock Telegraph Co., which required very heavy currents. Formerly they were obliged to use bichromate batteries, which ruined the building on account of the sulphuric acid vapors.

A discussion took place, in which MM. Sartiaux and Mercadier took part. It was brought out that the Western Union Company never having published anything on the subject of the cost of these installations, it was impossible to have exact figures concerning the economy effected by this system.

Mr. Aylmer continued the discussion in the name of Mr. Preece. In 1873 Mr. Preece had made trials at the Post-Office with the Gramme dynamo; the current was too variable for the Wheatstone system. He resumed the trials in 1883 by interposing accumulators. At the present time there were 220 circuits fed by 29 accumulators, charged once a month by the electric light machines. He had not yet determined the economy of the system. He hoped finally to replace his 30,000 cells by accumulators.

M. Paul Samuel then described a new telephone installation for individual call lines, invented by M. van Rysselberghe. In the arrangement in which the lines run through each instrument the bad effects due to the self-induction of the calling relays of the intermediate stations interfere considerably with the transmission of speech when the number of stations becomes large. The method employed by M. van Rysselberghe to overcome these effects is derived from the general anti-induction system. It consists in placing in shunt to the relays a condenser of one-half microfarad. These condensers play no part in the transmission of the calls, but they serve to propagate the telephonic undulations. There thus results a sort of double circuit, one side containing all the calling relays and the other all the condensers for the speech transmitted. In a case of twelve stations on one wire, the line was found to be, from a telephonic standpoint, in the same state as if it had been really cut by the condensers in as many places. But M. van Rysselberghe, in Belgium, and M. Charles Cros, in France, have shown that a similar circuit was perfectly adapted for telephony. M. van Rysselberghe's telephone in the Belgian section at the Exhibition is arranged for continuous currents, with a single battery for all the stations. The calls are made by breaking the circuit; a different signal is made at each station on the line. All the stations are thus protected from accident produced on the wire. Thanks to the condensers and relays there is an anti-induction arrangement which allows two stations to communicate by call in Morse signals, while two others communicate by telephone. The efficiency of this new system is the more marked as the length of the line increases.

M. Pierard observed that it was not necessary to use this system. On the lines from Whuy to Warennes, 30 kilometres in length with nine stations on the line, and that from Antwerp to Sant-Vliet, more than 40 kilometres in length, with 12 or 15 stations, the conversation is very good without special apparatus.

M. Maurice Kohn then read a communication entitled "On a New Arrangement for Constant Cells." The cell of M. Kohn consists of a conical zinc pole placed in a conical piece of rubber. The other pole surrounds the rubber, and the whole is held by a plate clamped by an insulating screw. By means of a second piece of rubber, the whole is placed in a porous vessel and this cell again in a glass vessel which contains the liquid. The screw is screwed to the bottom, and the cell can be turned upside down without danger.

Mr. d'Infreville called the attention of the section to a method of utilizing the Callaud battery for all purposes. He considered it the best battery. The glass vessel required to be very high, the copper low and vertical. It ought to be plunged in a concentrated solution of sulphate of copper. It was only necessary to add crystals when there were no more at the bottom of the vessel. They are introduced by

means of a lamp cylinder. The battery is ready for work after two or three days of short circuit, and the battery can work for three years by covering the sulphate of zinc with a layer of oil.

M. MERCADIER, remarked that he also used only large-sized Callaud cells at the Ecole Polytechnique, and he is very well satisfied with them.

M. BAUDOT observed that the slow diffusion of the liquids would cause the gradual rising of the sulphate of copper, to which Mr. d'Infreville answered that if the precautions indicated by him are rigorously observed the diffusion will not take place. The sulphate of zinc ought to be about a half concentrated solution. This can be determined by a small hydrometer.

PROCEEDINGS OF SECTION IV.—*Electro-Physiology.*

The section held no meeting to-day.

PROCEEDINGS OF SECTION I.—*Units and Measures.*

PARIS, FRANCE, Aug. 28, 1889.—M. Wuilleumier gave an account of the determination of the ohm which he had effected by the electro-dynamometric method proposed by M. Lippmann. The conductor, the resistance of which was determined, was a ribbon of German silver, 34.72 metres in length, 1 centimeter wide and 3 millimeters thick. Its resistance at 19 degrees C. was equal to 0.301889×10^9 C. G. S. units. It was then measured in legal ohms at the International Bureau of Weights and Measures by means of three copies of the standard ohm connected in parallel, and was found to be equal to 0.302650 ohm. The value of the true ohm was deduced from this, which is represented by the resistance of a column of mercury 1 square millimetre in section and 106.27 centimetres in length at 0 degree C. The sensitiveness of this method is very great and easily reaches $\frac{1}{10000}$; its precision is limited only by the perfection with which the coils are constructed, which consist only of a single layer of wire. It may be determined within $\frac{1}{2500}$ by this means.

Mr. PREECE proposed that the watt or power expended by a current of one ampère in a conductor at the terminal of which there is a difference of potential of one volt should be adopted as the practical unit of power. The kilowatt is then one ergten per second, which he had already proposed in 1881. Mr. Preece also proposed to take for the unit intensity of light the name of *lux*, which would be equal to the light produced by a Carcel lamp at a distance of one metre; that is practically the same light as that furnished by a standard English candle at a distance of one foot.

M. PILTSCHIKOFF remarked that neither the consideration of chemical work nor the theory of double electric layers sufficed to explain the action of electrolysis, and that it was necessary to consider the difference between the potential energies of the molecules of the metal before and after their passage through the electrolyte.

M. REGNIER demanded that the magnetic quantities be strictly defined.

M. LAURIOL returned to the question of notations and symbols, upon which he made some remarks, and M. Guillaume remarked that the first thing upon which it was necessary to come to an understanding was the employment of the comma in notations. Adjourned.

PROCEEDINGS OF SECTION II.—*Industrial Applications.*

Mr. CROMPTON read a memoir on the general rules to be followed in the establishment of secondary batteries designed for central station work, in the particular case where the accumulators are placed in series with the line, and where the current is distributed at low tension. These rules are as follows:

1. A battery of 54 cells ought to have a sufficient capacity to deliver 100 ampères for ten hours without dropping in electromotive force below 100 volts.

2. This battery ought to be charged by a current of 200 ampères and have a complete charge in 5 hours.

3. In a case of necessity, as, for example, in the case of an accident to the generators, the battery ought to be able to furnish during half an hour a constant current of 500 ampères without deteriorating, and at the same time maintain a difference of potential of 100 volts; that is, 1.86 per cell, including the fall of potential due both to the resistance of the connections as well as the internal resistance of the battery itself.

4. The efficiency ought to be normal when the charging current is 200 ampères, and that of discharge about 100 ampères.

5. The connections ought to be simple and to require but little attention, and a single movement ought to be able to manipulate six batteries of this kind.

6. The battery ought to be provided with regulating apparatus which ought to prevent the electromotive force from increasing 5 per cent. above the normal, and so as to allow the batteries to feed the conductors at different potentials.

7. The connections between the cells ought to be arranged so as to allow of the taking out of a set of plates and even of an entire cell for repair without interrupting the action of the battery.

8. The insulation of the battery and of its connections ought to be so perfect as to insure a minimum insulation resistance of 10,000 ohms, even during damp weather.

9. Each cell ought to be covered so as to prevent the flying about of acid spray and escape of vapors.

10. The containing cells ought to be absolutely free from the attack of the acid.

Major-General WEBBER drew attention to the results obtained by the Electrical Power Storage Company, of London, which furnishes 600 ampères at an electromotive force of 100 volts and feeds 2,000 lamps at 30 volts. The plant contains eight batteries of 54 accumulators. An experience of five months had shown that the consumption of coal is from five to seven kilogrammes per 1,000 watt-hours.

M. DRZEWIECKI then gave an account of "A New Chemical Theory of Lead Accumulators." After mentioning the various theories proposed in France and abroad, and basing his opinions on the condition of the plates, he declared himself against the theory of double sulphatation. M. Drzewiecki considered the concordance of the results relative to double sulphatation deduced from thermo-chemistry merely as a fortuitous circumstance. The negative plate would be a combination of hydrogen and lead, and the positive plate one of a higher oxide Pb^2O^5. During the charging there is formed a compound, $H^2Pb^2O^3$, perplombic acid. This endothermic combination is decomposed during the discharge and in passing through the form H^2O^2, and then directly into water and free oxygen, which combines in its turn with the hydrogen of the hydrate of lead to form water and metallic lead. According to the theory of double sulphatation the plates ought to increase in weight during discharge; according to the theory of M. Drzewiecki the opposite was the case.

M. G. ROUX defended the theory of double sulphatation, and recalled the fact that recent experiments published in *L'Electricien* has shown that the lead plate absorbed 1.41 grammes of sulphuric acid per ampère-hour, and the peroxide plate of 2.293 grammes, which forced the admission of the existence of two new sulphates of lead.

M. E. REYNIER objected to the theory on the ground that the unequal quantities of acid absorbed by the two plates were probably due to a systematic error resulting from the employment of the porous cup to separate the liquid from the two electrodes.

M. DRZEWIECKI admitted that the changes in density of the acid are due to a change in the concentration.

M. G. ROUX replied that an analysis of the liquid showed an absorption of acid of 3.70 grammes of acid per ampère-hour.

M. E. REYNIER then read a communication entitled "The Activity and Work of Voltaic Couples." He assumed as given that the voltaic couple under consideration completely utilized its energy to raise itself vertically. If e be the difference of potential of the external circuit, i the intensity of the current, then the power of the couple is $\frac{e\,i}{9.81}$ kilograms. If its weight is P kilograms the vertical height passed through per second is $\frac{ei}{P \times 9.81}$ metres per second. The activity is then $v = \frac{ei}{P \times 9.81} \times \frac{m}{s}$ and the work of the voltaic couple $W = \frac{Q\,e}{P \times 9.81}$.

M. Reynier showed by figures the relative values of primary and secondary batteries, and indicated a graphic method for representing these values. The following he claims to be the advantages of this method:

1. It requires no other unit than that of the metre.

2. It gives a direct relation which can be easily calculated or compared.

3. The figures which it furnishes are capable of graphic representation.

M. E. HOSPITALIER objected that these new ideas were useless, and that it sufficed to define the specific power in watts per kilogramme and the specific energy in watt-hours per kilogramme.

M. FAURE was of the same opinion as M. Hospitalier.

M. R. ARNOUX proposed to define the coefficient of merit of an accumulator as the product of the efficiency by the specific power.

M. HUBER remarked that this idea had been thrown out by Dr. Waltenhofen about three months ago. He demanded also that the capacity of accumulators of the Faure-Sellon-Volckmar type be given as a function of the active surfaces and not of the weight.

M. POLLAK proposed to indicate the constants of an accumulator in the following manner:

1. The initial electromotive force and the minimum limit at which it may stop at the end of the discharge.

2. The initial and final conventional capacity.

3. Life of the accumulator, not in time, but in ampère-hours.

M. HUBER remarked that the life of an accumulator depended entirely upon the treatment; and M. Faure was of the same opinion.

Mr. CROMPTON observed that the capacity of the positive plate increased with time, while that of the negative plate remained the same.

The PRESIDENT expressed the view that some understanding should be had as to the name of the two plates of the accumulator. Several members insisted upon the retention of the names positive and negative plates on account of the analogy with the names of the positive and negative pole. Others demanded that they be called respectively the red and the black plates. After a number of objections and answers presented by various speakers, the question was put to a vote which was declared to be indecisive, the same number voting each way. It was finally decided to postpone the discussion for a later meeting.

Mr. F. G. WORTH then handed in a memoir in the name of Mr. Webster on the electrical treatment of sewerage. This process has already been discussed in THE ELECTRICAL WORLD.

M. G. TROUVE then described to the section a Universal Direct Reading Dynamometer. This apparatus is constructed to measure the work furnished by a motor or any other moving machine. It consists of two parts, a dynamometer constructed to measure the pull or torque, and a revolution counter to measure the space passed over. In the tube which revolves the counter, there are fixed rectangular or circular vanes which, turning in air, mercury or water, encounter resistance depending upon their surfaces and the speed of the motor; it is therefore necessary to employ a series of vanes of various sizes and to graduate it experimentally in order to indicate the work developed by the motor.

PROCEEDINGS OF SECTION III.—*Telegraphy, etc.*

Publication of this was delayed.

PROCEEDINGS OF SECTION IV.—*Electro-Physiology.*

M. WEISS spoke on electrolysis, and, after a discussion, it was agreed upon that M. Weiss should postpone the description of the histological sections for the next meeting. M. Trouvé then presented his motors for running hydrostatic machines.

An important resolution was presented to the Conference from the American Institute of Electrical Engineers stating it to be the intention to hold an International Electrical Conference in 1892 in connection with the World's Fair of that year, and asking that a committee be appointed from the Paris Conference which shall enable the American Conference in 1892 to continue the work of that body. Action will be taken at the final general meeting on Aug. 31, and a committee be appointed.

PROCEEDINGS OF SECTION III.—*Telegraphy, Telephony and Signals*

PARIS, Aug. 28, 1889.—The meeting was opened by communications read by M. Palaz on "The Relation between the Vicinity of Telephonic and Power Wires." M. Palaz pointed out that sufficient attention had not been bestowed on this subject, and that the disturbances which are observed when these two systems are in close proximity are such as to make some definite arrangement so as to avoid them of the greatest importance. After a very able paper, the conclusions he arrived at are as follows:

1. Electric power circuits ought to be complete metallic circuits, and as well insulated as possible.

2. Telephonic circuits ought to be complete metallic, so as to permit of, *a*, the future development of extra-territorial traffic; *b*, the simultaneous working without disturbance of telephonic and power circuits.

M. VASCHY gave the results of several experiments on the effects of these two classes of wires on each other. M. Palaz during the discussion also remarked particularly the disturbance caused by the leakage from power circuits.

M. BANNEUX, of the Belgian telegraphs, laid special stress on the bad effects of placing repeaters in the circuits, which reduced enormously the strength of the voice. He showed that communication could be had with a double iron wire circuit of 4 millimeters diameter for a distance of 300 kilometers, if they are directly connected to the line. For all new lines and exchange systems the Belgian administration requires two wires; even in the largest exchanges the company is obliged to furnish double wires to the subscribers, for which an extra charge is made.

Mr. D'INFREVILLE remarked that in the United States the companies were also obliged now to enter energetically in the construction of double wire circuits.

The president of the section then put to a vote the resolutions of this section, which were adopted as given in the report of the last day's proceedings.

Mr. D'INFREVILLE also drew attention to the method of arranging the lines by taking two circuits in order to form a new closed circuit, each of the preceding circuits constituting a new wire, and so on. The discussion was also taken part in by MM. Belugou, Borel and Piérard.

M. MERCADIER then read a paper entitled "The Monotelephone or Electromagnetic Resonator." This monotelephone is a logical outcome of the ideas of the author given in Monday's proceedings. The telephone only reproduces the first harmonic. The diameter of the neutral line is $0.68 \times D$; D being the diameter of the plate. Three holes are pierced into the plate, into which can be introduced three rods, which can be fixed as desired; the coil can be approached more or less to the vibrating plate.

A communication by Mr. Dumont was also announced, entitled, "The Electric Regulation of Time by Telegraphic Wire."

PROCEEDINGS OF SECTION I.—*Units and Measures.*

PARIS, Aug. 29, 1889.—The Committee appointed for the purpose brought in the resolutions to their section on the adoption of the joule and the watt, which are given in the report of Saturday's proceedings, to be found below. A discussion followed their reading.

PROCEEDINGS OF SECTION II.—*Industrial Applications.*

M. R. ARNOUX presented a paper entitled, "On an Experimental Study of the Dynamo." He showed the various differences observed by different investigators on dynamo machines and the disturbances that were caused by the various factors.

This was followed by a paper by M. J. Laffargue on "The Economy of Electric Circuits." This was a study of a laying out of a system in which the author sought to obtain the best economy in cost of wire. He made calculations on the single multiple circuits, the circuit with a return wire for equalizing potential, tapering circuit, and circuits with 2, 3 and 5 centres of distribution. The result gave an economy of 20 per cent. for the system with two centres of distribution over that for the auxiliary return wire system; 24 per cent. for the 3-centre distribution; 57.6 per cent. for the 5-centre distribution, and 36.5 per cent. for the simple multiple circuit. As to the economy obtained by the three-wire system over the two-wire system it varied between 60 and 68 per cent. The discussion on this paper was taken part in by MM. Picou, Desroziers and Crompton.

M. TURETTINI, of Geneva, then furnished some information on an installation which he had made, and gave expression to the idea that in central stations for distribution by accumulators a method for overcoming the loss of potential during discharge ought to be adopted in every case. He employed a dynamo which operated a second dynamo so arranged as to maintain the potential constant. It was, in other words, a continuous current transformer system, the efficiency of which reached between 75 and 80 per cent. The ordinary drop of potential between charge and discharge would be 25 per cent., but with his method it did not exceed from 2 to 2.5 per cent.

M. CHARLES JACQUIN then described a method of measuring easily every day the insulation resistance of a central station conductor system. The measurement was effected with the regular dynamos in use—giving, say, 100 volts potential. One of the poles is connected to a galvanometer and the other to the earth. The galvanometer may be connected to the conductor whose insulation it is desired to measure. A voltmeter measures the difference of potential. The galvanometer employed is of the Deprez-D'Arsonval type with a microscope, which can be easily placed on a switchboard.

M. JACQUIN also gave an account of experiments made on a single conductor cable with alternating current in order to obtain the loss caused by induction, Foucault currents and hysteresis in the armor of such a cable. A wattmeter with an alternating current dynamo gave the total power P (total) dissipated in the cables, and with a continuous current machine the power $R\,I^2$ expended in the conductor: Since $P\,(\text{total}) = R\,I^2 + P\,(\text{diss.})$; P (diss.) being the power dissipated or lost. The power dissipated in the armor can thus be easily found. M. Jacquin has found that a lead tube does not consume more than 2 per cent. of the $R\,I^2$. With a lead and iron armor the loss is 18 per cent. of $R\,I^2$ and 35 per cent. if the armor is in closed circuit on itself.

PROCEEDINGS OF SECTION III.—*Telegraphy, Telephony and Signals.*

M. CHAYE read a communication entitled "On the Utility of Finding an Annunciator or Sounder for Submarine Application." He recalled the attempts made with the object of gathering the sounds produced within the body of a liquid mass. The best instrument is the telephone combined with a microphone. The microphone is placed in a metallic water-tight box, resting on the bottom or suspended in the water. In this way the noise of a building in which there is a steam engine can be heard at 200 meters. The new system described is susceptible of various applications. The author then proceeded to describe these and he mentioned several utilizations such as means for allowing ships to communi-

cate with each other and to recognize their approach, and for other marine work. He described a special arrangement for determining the direction of an approaching ship, which Professor Hughes remarked was very ingenious.

M. SAMUEL then read a paper on the "Multiple Telegraph Printer of M. Munier." According to the author, the Hughes apparatus answered perfectly for the ordinary service. Therefore M. Munier has worked in the direction of finding a practical arrangement permitting of the grouping together of several Hughes apparatuses in multiplex on the same wire when the traffic becomes heavy.

The number of contacts per apparatus is not more than seven (two of which are earth contacts), instead of twenty-eight, and the number of impulses per letter never exceeds two. Six letters can be printed with a single-current impulse, and this number can be carried as far as ten. The manipulation is done on an ordinary Hughes keyboard, and a single key only is pressed for each letter. The multiple apparatus can be instantly transformed into the simple apparatus. The simplicity of the manipulation allows the speed to be pushed to its maximum, that is, to 150 turns per minute; hence in the quadruplex arrangement 600 letters can be transmitted per minute instead of about 180 letters per minute by the simple circuit. M. Munier obtains these results by the application of a new principle called "the principle of fractional keys." This application is of very great mechanical simplicity, and offers great advantages from the standpoint of the line discharge.

M. DUMONT then described his electric disc for telegraph transmission. He showed that a motor can be made to move on a vertical shaft which turns the disc by means of a double chain. This shaft carries two cams against which there successively strike five teeth of a wheel mounted on the shaft, which also carries other pieces. This disc has been in operation at the du Raincy railway depot since 1886.

M. BANNEUX, returning to the question of telephonic transmission, remarked that it was a very complex one. A distinction had to be made between local conversations, those at long distances and those for very long distances, and it was impossible to determine upon any fixed price for communication. In Belgium the district is considered local within a radius of 10 kilometres. On the line from Brussels to Antwerp the number of conversations in June were as follows:

Duration in minutes	1	2	3	4	5	6	7	8	9	10	
Number	81	499	516	320	109	14	33	19	16	64	Total, 2,071

The discussion was participated in by Messrs. Mayer and Major-General Webber, of London.

PROCEEDINGS OF SECTION I.—*Units and Measures.*

PARIS, August 30, 1889.—The meeting was opened by the section approving the conclusions of the committee on units relative to the adoption of the watt and joule, and given in the last day's proceedings.

M. GOLDHAMMER, after recalling the formulas of Leduc and Tomlinson, gave an account of his researches on nickel. The results obtained are in accordance with those of bismuth, with the following law: The alteration in resistance is proportional to the square of the intensity of magnetization.

M. STOLETOW gave a resumé of his experiments on the electric discharges induced by radiation (actino-electric phenomena), and added some critical remarks on the different hypotheses which have been made, in order to explain these phenomena.

M. PILLEUX then enunciated the following law: If a thermo-electric couple operates between the temperatures T and T', and we call k the mean coefficient of the variation of electric conductivity of one of the two metals between the temperatures T and T', between which the couple acts, and k' that of the other metal, we will have

$$E = (k - k')(T' - T),$$

E being the electromotive force of the couple.

M. PILLEUX gave a large number of examples in verification of this law.

Sir WILLIAM THOMSON remarked that if we considered two or three pure metals, such, for example, as iron, copper, silver and an alloy like German silver, this law would not be found to be exact.

M. MARIN then presented a paper on the movement of fluids and their application to the theory of electricity.

M. TROUVELOT presented some photographs of electric sparks.

M. GOURE DE VILLEMONTEE then presented some results of experiments on the influence of gas in potential equalizers, based on the fall of water; by a method of zero reduction he has been able to determine a very decided influence of carbonic acid on the indications.

Sir WILLIAM THOMSON remarked that this was due to a modification of the surface of the metal by the action of the gas, and it is probable that the effect would be much larger with active gases like oxygen or sulphuretted hydrogen, or by taking nitrogen on the one hand and oxygen or atmospheric air on the other. The polish of the surface might also have some action.

M. COURTOIS then presented some photographs showing the effect of the passage of the current in wires.

M. PELLAT observed that in order to obtain absolute precision with his electro-dynamometer it would be necessary to construct a second standard instrument of the type which he had already constructed.

SIR WILLIAM THOMSON expressed the wish that M. Pellat would make a second absolute instrument in order to verify the first, and the section seconded his proposition to that effect.

PROCEEDINGS OF SECTION II.—*Industrial Applications. First Session.*

The meeting was opened by M. C. A. Faure, who, after paying a tribute of gratitude to the memory of M. Planté, gave his ideas as to the construction of a perfect accumulator. According to his ideas, it ought to be composed of two inoxidizable plates uniformly covered with active matter. The active matter plays also the part of a conductor, and the part which acts in this way, according to different constructors, is from three to six times as great as that which takes or furnishes the oxygen or is electrolysed. M. Faure finally remarked that the accumulators of the Planté type have the advantage of presenting a relatively large quantity of electrolysable matter, but that the support is oxidizable. The employment of a lead antimony alloy obviated this difficulty. M. Faure considered that the value of an accumulator could be easily predetermined, from the standpoint of its capacity, as being exactly proportional to the weight of the active matter, provided that this matter was in close contact with the support and facilitated the formation of parallel lines in the passage of the current.

M. G. ROUX presented, in the name of M. Raverote, a note "On Compound Machines With Variable Speed." He remarked that as a rule compound machines required an engine of very steady speed as one of the conditions of its successful operation. He had constructed a machine in which a certain variation of speed was permissible without interfering with its potential. This was accomplished by means of a very simple electrical arrangement which could be very generally applied. As an example, he cited a compound machine wound for constant potential, which was calculated for 1,400 revolutions, and on account of some circumstances connected with the installation it was desired to operate it at 1,450 revolutions. At this speed the dynamo was no longer exactly compounded. It required a certain attention and the operation of the ordinary rheostat included in the shunt circuit. In order to insure its proper action at the new speed it was necessary to reduce the strength of the series winding. This was accomplished practically by putting in shunt on the series winding a resistance, so that the series winding received no more than about 98 per cent. of the total current in the armature.

M. CHARLES JACQUIN, after passing rapidly in review the curves representing the elements of alternate current machines with and without self-induction and transformers without iron, showed curves relating to a transformer containing iron, or the real transformers. These curves give the values of the elements of a transformer of 7,500 watts; that is to say, the current, the power furnished and expended, the efficiency, etc., as a function of the time, resistance and the work furnished by the secondary circuit. This last curve was the most interesting, as it allows of the construction of characteristic curves of a transformer of any system.

Prof. GEORGE FORBES then presented to the section a new form of his meter, with which the readers of THE ELECTRICAL WORLD are already acquainted. In the new instrument Professor Forbes has, however, introduced some improvements. There is now no clock movement employed, and the current, instead of passing through a spiral, passes through a circuit arranged like a ladder, with cross connections between two parallel circular wires.

M. E. HOSPITALIER spoke on the subject of alternate currents, and without insisting on the creation of any new names demanded the exact definition of the quantities

$$\sqrt{(E^2)}\,(\text{mean}),\quad \sqrt{(I^2)}\,(\text{mean}) \text{ and } \sqrt{R^2 + \left(\frac{2\pi L}{T}\right)^2},$$

and their corresponding units which are often met with in the study of alternate currents. The discussion of these propositions was postponed to a later meeting.

M. DECAUX gave the results of experiments obtained by the action of the electric light on colored cloths and on paintings. The employment of electric light permitted the easy determination of the resistance to light of different colors.

M. RICHARD FRERES presented several apparatuses for speed indication and electric registers of various kinds.

At the request of M. E. BOISTEL, the President gave his opinion on the manner of explaining the shifting of the brushes necessary in dynamos due to the reaction of the armature. The reaction of the latter is determined by the defect in the symmetry of the magnetic field with respect to the line of the brushes; the magnetic flux across a section of the armature is varied, even in the same machine at rest with a current strength, I passing through the armature, for all sections other than those which are parallel or perpendicular to the axis of symmetry of the field. This is shown by measuring with a ballistic galvanometer the variation of the flux which passes through a wire wound on the armature when the current intensity I is varied. This variation changes sign with the direction of the current and the position of the section, whether to the right or left, of the neutral line; that is to say, that in a generator there is a diminution of flux when the brushes are in advance of the neutral line corresponding to $I = 0$; and an increase when the brushes are behind. The same action is observed even when the field magnets are not excited.

M. POTIER proposed the formula

$$v = \sqrt{\frac{MW'}{W}}$$

as the value of the magnetic system of a machine having the power W; v being the linear velocity, W' the power consumed in the excitation of the field magnets, and M the weight of the copper on the field magnets.

Second Session.

M. HOSPITALIER insisted on the necessity of defining the quantities employed in alternating current work, and of giving them special names, as well as the practical units derived from the C. G. S. system, which served to measure them. After discussion and various observations by MM. Potier, Ferraris, Kapp, Picou and others, the section adopted the resolutions, which were finally presented to the General Meeting and which are given in the last day's proceedings.

PROCEEDINGS OF SECTION III.—*Telegraphy, Telephony and Signals.*

The meeting was opened by a discussion on the time to be allowed for conversations on telephone circuits. After various propositions the section adopted a resolution fixing three minutes as the limit. The President put the following to a vote:

1. That by the word intra-urban be designated all traffic between two subscribers or public stations connected to different exchanges.

2. That the unit of intra-urban conversation be fixed at three minutes.

The President then submitted the question whether the number of successive conversations given to the same person should be limited. A large number took part in this, and the majority were in favor of refusing to maintain communication longer than three minutes when there were other calls for the wire.

M. WENNMANN read a communication in English on the influence of the telephone on telegraphic activity, which showed the influence that the increase in the number of telephonic messages had on the telegraph service. The fact was developed that if the locality is a large city, the total number of telegrams would hardly be influenced.

M. BAUDOT read a communication on "Some Recent Improvements in the Multiple Printing Telegraph." M. Baudot applied the system of time division and work division. The electrical condition of the wire has great influence, but these effects can be corrected. The influence of the currents induced by neighboring wires is beyond the control of the operator, This influence is the less the more sensitive the apparatus is. M. Baudot employs a polarized relay which operates with a current of 0.5 milliampère.

Mr. D'INFREVILLE remarked that he had patented in the United States eight years ago the following system. The line is put to earth through an ordinary relay. Each of the stops of the armature of this relay is connected to a battery of opposite polarity. The other pole of each of these batteries is connected respectively to the incoming and outgoing terminals of the polarized relay, which puts a receiver in movement. This system gives very good results by obviating the bad influence of neighboring lines.

M. BOURDIN gave the results of experiments on the application of the Gaulard & Gibbs transformers in telephony. He replaced the bobbin of the microphone by a small transformer; he hopes thus to reduce the diameter of the extra territorial telephone lines.

The paper by M. Dumont "On the Standardizing of Time by Means of Telegraph Wires" was then read. For some time past the regulators placed in the different points of the depot of the Eastern Railway in Paris are synchronized electrically by means of the large clock in the façade. The system consists in stopping the escapement of the clock if it is ahead of time, without stopping the vibrations of the pendulum. The escapement is stopped for exactly the length of time which the clock has gained or lost. When the escapement is again freed the pendulum drives the clock in the usual way.

PROCEEDINGS OF SECTION IV.—*Electro-Physiology.*

M. TROUVE presented to the section a vibrator or interrupter for medical work, which was designed to give the same strength of current, independent of the number of impulses per second.

Mr. JOSEPH WETZLER then addressed to the section some remarks on the present state of the question of electrical execution in the United States. The opinion of the section was general that this method was not the best which could be employed.

CLOSING PROCEEDINGS, SATURDAY, AUG. 31.

PARIS, Aug. 31, 1889.—The meeting was opened by the President, who, after making various announcements, proposed the name of Thomas A. Edison as vice-president for America, which was adopted unanimously.

M. CARPENTIER then gave an account of the results obtained with the mercury standards constructed according to the decisions of the International Congress of 1881. From the experiments of MM. Benoit and Carpentier it resulted that the standard of mercury presented an absolute character; the differences observed during several years did not exceed the errors of observation.

The PRESIDENT then put to a vote the various recommendations adopted by the different sections as follows:

The practical unit of work is the Joule. It is equal to 10^7 C. G. S. units of work; it is the energy expended during one second by one ampère through a resistance of one ohm.

The practical unit of power is the Watt. It is equal to 10^7 C. G. S. units of power. The watt is equal to one joule per second.

In practice the power of machines shall be expressed in kilowatts instead of horse-power.

To determine the intensity of a lamp in candles, the practical unit shall be the decimal-candle (bougie-decimal), which is equal to the $\frac{1}{10}$ part of the absolute standard of light as defined by the International Congress of 1884.

The practical unit of the coefficient of induction is the quadrant. Quadrant = 10^9 centimetres.

The period of an alternating current is the duration of a complete oscillation.

The frequency is the number of periods per second.

The mean intensity is defined by the relation:

$$I\,(\text{mean}) = \frac{1}{T}\int_0^T I\,dt.$$

The effective intensity is the square root of the mean square of the intensity of the current.

The effective electromotive force is the square root of the mean square of the electromotive force.

The apparent resistance is the factor by which it is necessary to multiply the effective intensity in order to obtain the effective electromotive force.

In an accumulator the positive plate is that which is connected with the positive pole of the machine during charging, and which is the positive pole during discharge.

The Congress recommends as a means of determining the degree of incandescence of an incandescent lamp the method proposed by M. Crova and adopted by the second section.

The metallic circuit is adopted for city telephone circuits and for intra-urban (extra-territorial) traffic. By intra-urban is meant all telephonic communication had between two subscribers or public stations which form part of different groups or exchanges.

The President also put to a vote the following: *The unit time of intra-urban conversation is fixed at three minutes.* After some discussion, however, it was decided that this was a question of private administration and that the Congress could not legislate on that potnt.

M. CHAVEZ read a memoir, in which he attributed an important part in electro-genesis to the capillary actions whose part in osmose came in independently of the diffusion, to which Mr. Weiss objected, for the reason that in the capillary vessels there was no superficial tension.

M. GAIFFE indicated a method for the comparison of induced currents, after which the section adjourned.

President MASCART then delivered his closing address, in which he reviewed the work done by the Congress, and thanked the members for the attention which they had given to the work. His address was greeted with great applause. During his remarks he complimented the great work done by Sir Wm. Thomson, and after he had finished Sir William arose and expressed his thanks for the kind sentiments uttered by the President. He sat down amid great applause.

On Saturday evening a grand banquet was tendered to the foreigners present by the French members of the Congress. Covers were laid at the Hotel Continental for 350 guests. Toward the end of the banquet M. Mascart arose and in a few befitting words expressed the kind sentiments of the French members toward the foreigners present. He was followed by M. Cochery, Berger and a number of others. In responding to the toast to America, M. Abdank spoke for the Americans present, returned thanks for all the kindnesses received, and expressed the hope and belief that America would be allowed to reciprocate in 1892. The

members kept together until quite late, and the affair was one of the most enjoyable events of the whole Congress.

WETZLER.

NOTES.

On Monday, President Carnot gives a dinner to the presidents and vice-presidents of the conference.

On Wednesday evening M. Joubert repeated some of the experiments of Hertz before the members of the Conference, and showed some of the remarkable effects of electric radiations and their reflection.

The members of the Congress have been very kindly treated by their French confrères, and invitations to visit various places of interest have been numerous. Thus, on Tuesday the members of the Conference visited the shops of Messrs. Sautter-Lemonnier, and the workshops of the Société Generale d'Electricité. The number attending was so great that they had to be divided into sections.

On Friday night, in behalf of THE ELECTRICAL WORLD and American electricians, Mr. W. J. Johnston, assisted by Mr. J. Wetzler, entertained the president of the conference, M. Mascart. The following gentlemen were also present: Messrs. T. A. Edison, Forbes, Tesla, Hospitalier, Hering, Preece, Kareis, Kapp, Hughes, Abdank, W. H. Snell, d'Infreville, Thurnauer, Parsons and Crompton. A most enjoyable evening was spent.

On Tuesday evening a reception was given to Mr. Edison by the Administrative Council of the British section at the exhibition in the English Pavilion. The reception was largely attended. A number of phonographs were shown in operation, and the Grand Opera House was connected with the pavilion by telephone. A dozen telephones ranged round a table allowed the visitors to hear the opera being presented there. The reproduction was beautiful in the extreme.

Thursday afternoon the members visited the electric installations at the Palais Royal and in the Grand Opera House. At the latter place the members were permitted to go on the stage, and the lights were manipulated for their benefit, showing the various means of changing the illumination, both in strength and color, to suit different scenes. Visits were also paid to the St. Lazare railroad station, where there is a large electric plant. Thursday evening M. Abdank made experiments with Prof. Elihu Thomson's apparatus at the exhibition, and demonstrated the remarkable action of the alternating currents. Besides this, Prof. Bjerknes demonstrated during each afternoon of the Congress his experiments on the analogies between the electro-dynamic and hydro-dynamic phenomena. These experiments were made in the Norwegian pavilion of the exhibition.

Eleventh Meeting of the National Telephone Exchange Association.

The eleventh meeting of the National Telephone Exchange Association was begun at the West Hotel, Minneapolis, Minn., on Sept. 10, 1889. The following gentlemen were in attendance:

ALBANY, N. Y.—A. B. Uline.

ATLANTA, Ga.—W. J. Cole.

AUSTIN, Tex.—F. B. Knight.

BERLIN, Germany—G. Wabner.

BOSTON, Mass.—Geo. Albree, Thos. B. Doolittle, I. H. Farnham, Geo. G. Hall, H. V. Hayes, Wm. A. Hovey, Jasper N. Keller, Thos. D. Lockwood, A. O. Morgan.

BRIDGEPORT, Conn.—Henry D. Stanley.

BROOKLYN, N. Y.—Frank C. Mason, H. H. Pitcher, Wm. D. Sargent.

BUFFALO, N. Y.—J. C. Culbertson, E. J. Hall, H. C. Palmer.

CHARLESTON, S. C.—Jno. D. Easterlin.

CHICAGO, Ill.—F. G. Beach, C. H. Cone, F. E. Degenhardt, J. W. Dickerson, W. G. Halm, J. M. Jackson, M. A. Knapp, W. A. Kreidler, Mr. Meaney, W. R. Patterson, G. W. Smith, C. H. Wilson.

CINCINNATI, Ohio—Geo. N. Stone, E. V. Cherry.

CLEVELAND, O.—J. P. McKinstry.

DETROIT, Mich.—F. A. Forbes.

ELMIRA, N. Y.—Wm. N. Eastabrook.

GALVESTON, Tex.—G. W. Foster.

HARRISBURG, Pa.—Jos. R. Davis.

HOUGHTON, Mich.—Jas. R. Dee.

KANSAS CITY, Mo.—Chas. W. McDaniel, W. W. Smith.

LOUISVILLE, Ky.—H. N. Gifford.

LOWELL, Mass.—Abner S. Adams, Chas. E. Adams, J. W. Bennett, Chas. J. Glidden, J. W. C. Pickering, Levi Sprague.

MANCHESTER, N. H.—J. A. Weston.

MINNEAPOLIS, Minn.— — Christie, S. S. Leonard, H. McGuire, I. McMichael, H. A. Tuttle, Arthur C. Whidden, E. P. Wainman.

MONTREAL, Can.—C. F. Sise.

NEWARK, N. J.—Cyrus O. Baker, Jr.

NEW BEDFORD, Mass.—Samuel Ivers.

NEW HAVEN, Conn.—Morris F. Tyler.

NEW YORK, N. Y.—Gen. C. H. Barney, D. I. Carson, John J. Carty, Joel C. Clark, Wm. H. Eckert, Melville Egleston, Edward J. Hall, Jr., A. S. Hibbard, M. M. Hayden, Chas. F. Johnson, Geo T. Manson, E. B. McClees, J. P. McQuaide, Chas. W. Price, H. L. Storke, Clarence E. Stump, J. B. Taltavall, Henry B. Thayer.

NEW ORLEANS, La.—A. W. Crandall.

OMAHA, Neb.—Flemon Drake, J. J. Dickey, L. H. Korty, Geo. Y. Wallace, C. E. Yost.

PHILADELPHIA, Pa.—H. S. Huidekoper, Dr. S. M. Plush, Chas. H. Porter, W. T. Westbrook.

PITTSBURGH, Pa.—J. W. Marsh, Henry Metzger.

RICHMOND, Va.—C. E. McCluer.

STILLWATER, Minn.—B. F. Freedy.

ST. LOUIS, Mo.—A. G. Fuller.

ST. PAUL, Minn.—Henry C. Hope, W. B. Joyce.

WASHINGTON, D. C.—Jas. M. Brown.

WILLIAMSPORT, Pa.—R. M. Bailey.

The meeting was called to order by President Henry Metzger, of Pittsburgh.

Secretary BARNEY reported the resignation of Mr. C. B. Hotchkiss, and the Sunset Telephone Company, of San Francisco (consolidated with the Pacific Bell Telephone Company), and application for associate membership from Felten & Guilleaume, the cable manufacturers of Cologne, Germany. His report, then presented, showed also that the Callender Company would be dropped from the list. The close of the fiscal year showed 34 active, 6 associate and 28 honorary members. The receipts of the association for the year were $2,025.37 and the disbursements $1,980.81.

A brief address of welcome was then delivered by Judge Atwater in behalf of the city and of the Board of Trade, and was responded to by President Metzger.

An invitation was read from the Northwestern Telephone Exchange Company for a carriage ride; a visit to Minnehaha Falls; a carriage ride to St. Paul and dinner at the Hotel Ryan, St. Paul, on Sept. 12. It was duly accepted.

An invitation was read and accepted, from General Manager S. S. Leonard, to visit the station of the Minnesota Brush Electric Company.

The meeting then proceeded to the election of officers.

Mr. W. D. SARGENT, of Brooklyn, was unanimously chosen president.

Mr. F. G. BEACH was elected vice-president.

Mr. H. L. Storke was re-elected treasurer.

Messrs. C. F. Cutler, C. H. Wilson, Gifford and Levi Sprague were elected as the Executive Committee.

Messrs. E. J. Hall, Jr., M. F. Tyler, and G. N. Stone were elected as the Advisory Committee.

Mr. TYLER then presented the following set of resolutions, which he prefaced with some very felicitous and touching remarks:

WHEREAS, since the last meeting of this association we have lost by death our ex-president, Geo. L. Phillips,

Resolved: That this association regards the death of Mr. Phillips as at once a most serious loss to the business in which we are all engaged, and a great bereavement to this body. Prominent as he was in its organization, efficient and capable as its first president, active and sagacious in its subsequent deliberations he, more than any other man, stood for and represented this association. In its connection with the general business, only those directly associated with him can fully appreciate his unflagging energy, tact, foresight and devotion to its advancement. His heart, as well as his brain, were in it.

Resolved: That this association further takes this opportunity of recording its esteem and affection for Mr. Phillips as a man. He will be missed as a personal friend by all its members, and his death has been felt by each to be a private grief. The association feels that it can no better express its feelings at his death than by the simple words "We loved him."

Resolved: That the secretary convey to Mr. Phillips' family the expression of our deep sympathy with them in their loss, together with a copy of these resolutions.

Mr. METZGER seconded the resolutions.

Messrs. Lockwood, Carson, Jackson, Cherry and Wiley Smith added their eulogies of Mr. Phillips, as also did President Sargent. The resolutions were unanimously adopted by a rising vote.

Application for reinstatement in membership of the Cumberland Telephone Company was then read and referred to the executive committee.

An invitation was accepted from Chas. A. Pillbury & Co. to inspect Mill A, one of the sights of Minneapolis.

An invitation was also accepted to visit the Minnesota State Agricultural Society's Fair.

The meeting then adjourned till 3 P. M.

At the opening of the afternoon session, Mr. T. D. Lockwood presented Mr. Gustave Wabner, who has charge of the telegraph and telephone department in the city of Berlin, Germany; and the privileges of the floor were extended to this gentleman.

The North American Telegraph Company, through Superintendent H. A. Tuttle, placed the use of its lines and the Postal's at the free disposal of the delegates for all personal messages. This was accepted with thanks.

The association then passed favorably on the applications for membership, and went into executive session with closed doors.

The following paper was then presented by A. S. Hibbard, J. J. Carty and F. A. Pickernell on

A NEW ERA IN TELEPHONY.

During the past three or four years much has been written and said about long distance telephoning and the work of the American Telephone and Telegraph Company, of New York. It has been announced that in the experiments carried on by this company a perfect telephone service has been accomplished, either for long or short distances. As the extension of the so-called "long distance" lines has progressed, it has been shown in many of the Eastern cities that these results are accomplished, not only experimentally, but practically, and so reliable and perfect is this telephone service, even at very long distances, that it has become an integral factor in the most important departments of trade and commerce, and as much to be depended upon as mail or railway service.

The steady and gratifying increase in business over the "long-distance" lines has shown that the public will appreciate good and satisfactory telephone service when it is provided, and the demand for this perfected service may be said to have created a new era in telephony.

While some improvements in apparatus have been incident to the new service, the principal factor has been the proper use of metallic circuits in telephone work. By means of metallic circuits properly arranged, all inductive interference from adjacent lines of telephone, telegraph, electric light or power wires, as well as disturbances from atmospheric or earth currents, has been overcome. Circuits have been successfully operated through longer lengths of submarine or underground cables than has heretofore been practicable, and late conferences have provided a standard specification for cable manufacture. Metallic circuit switchboards have been provided, even in large exchanges with the multiple system, and the long distance cabinet instrument has been applied for the convenience of the subscriber. Thus there has been supplied what would seem to constitute all the necessary provisions for the new service. These component parts, however, although essential to it, will not, in themselves, accomplish the desired result.

It has been the experience of the American Telephone and Telegraph Company that grounded circuit methods, as they have been generally practiced in telephony, are not satisfactory when applied to metallic circuits. Many radical changes have been made. The great underlying principle has been found to be that a perfect balance of the two sides of the circuit throughout its entire length is necessary to the best results, and to maintain and preserve this balance requires the closest attention to every detail. In other words, the new service requires, first, proper engineering; and second, a force educated and trained to carry out the plans provided.

As representative of the practices in vogue at the present date, we give in detail the specifications of a local metallic circuit and its usual extensions.

At the subscriber's station should be placed a long distance cabinet set; this is in the form of a small desk, and is supplied with the usual working parts of a magneto bell, wired with waterproof insulated wire on a grooved baseboard, so laid out that no two wires cross each other at any point. The telephone hook is provided with platinum contact points. The binding posts are of the double lock nut style, and provide a large bearing surface for the attached wires. The line wires are led to fusible coil arresters, which burn out with a current of one half an ampère, combined with two plate arresters, having an area of about one-half a square inch and insulated from the ground-plate by a strip of mica. Underneath the desk a battery-box is provided, which is capable of holding three 6×8 jars. A push button is placed conveniently, by means of which the subscriber is enabled to cut out the secondary coil of the transmitter, thus lessening the retardation in the circuit, and at the same time removing the microphonic disturbances caused by his own transmitter.

There should be used on this cabinet set generally three cells of open circuit battery. The internal resistance of each cell of battery should not exceed one-half an ohm, and the electromotive force should not decrease over fifteen per cent. after the three cells of battery connected in series are short circuited through a resistance of seven ohms for twenty minutes. In cases where the transmitter is to be used for longer periods, it is necessary to use a constant current battery. We find the Fuller battery to give the best results under such conditions.

For the interior office wire, nothing less than copper wire .0403 inch in diameter, insulated to $\frac{4}{32}$ of an inch, with the best quality of waterproof insulation, is to be used, clamped to the wall by wooden cleats if possible.

The wires should enter the building through hard rubber tubes, which are so inclined that no water can leak in. From this point to the roof rubber-covered wire should be used, extending to the overhead conductors, all connections being made with McIntire sleeves or soldered. The line wires should be hard drawn copper, having a diameter of at least .08 inch, and supported every 125 feet. Copper wire is recommended on account of its low resistance, its low electro-static capacity, as compared with iron or steel wire of the same conductivity; its low coefficient of self-induction, and especially its durability. There is little depreciation in copper wire after it has been strung, the gases common to large cities having very little action upon it, and its life is very many times greater than that of iron or steel wire, thus rendering it in the end the most economical.

In making joints in hard drawn copper wire the McIntire sleeve should be used.

In building the loop, both sides of the circuit should occupy adjacent pins on either housetop fixtures or on pole line, thus causing the relative distance of the two sides of the circuit, toward foreign wires, to be the same throughout their course. This is of great importance if the loop is of sufficient length to render transpositions necessary. On exposed housetop fixtures nothing but waterproof insulated wire is to be used. From the cable fixture, bridle wires, not less than .0403 inch in diameter, insulated $\frac{5}{32}$ of an inch with the best quality of water-proof insulation, extended through cleats on the under side of the cross arm to wooden ducts fastened to the back of the cross arms, or through properly constructed cables, should lead to the cable box or tower. The bridle wires should be joined to the line wires either by McIntire sleeves or by soldering. Care must be taken not to solder to the line wire between supports, as heating the hard-drawn copper anneals it and reduces its tensile strength.

Inclosing the cable terminal we have used a dust and moisture proof iron cable tower, cylindrical in shape, built completely round the pole, and supplied with a suitable platform and railing. A complete description of this tower may be found in the report of the last Cable Conference. If a wooden box is used it should be made of $1\frac{1}{2}$ inch pine, tongued and grooved, having double doors hinged at the top and opening together. Its interior dimensions should be sufficient to give a space ample for placing the cable head, lightning arresters and bridle wires. The box should be well oiled on its interior and painted thoroughly on the outside before placing in position, the joints being white leaded before the box is put together. The terminal tower or box is be locked, and it is recommended that a standard padlock be adopted and used for this purpose. In this tower or box the bridle wires are connected to the plate and fusible arresters. To protect the cable against heavy electrical discharges, we provide at the exterior terminal fusible coils and properly constructed plate or pointed lightning arresters. The fusible coil at this point is so designed that it burns out with a current of one ampère, thus having twice the carrying capacity of the central office arrester; this protects the cables and prevents a large number of burn-outs at points remote from the office, locating most of them at the office terminal, where they may be quickly repaired. The outside wires extend first to the plate arrester, which discharges the lightning to ground at the cable pole and prevents the burning out of many fusible coils. The ground plates upon the arresters should be connected to moist earth by means of conductors run independently of the cable sheath, and having three times the conductivity of the line wire. For this purpose, three No. 12 hard drawn copper wires twisted together may be used.

The arresters should be connected to the cable heads by waterproof insulated wire.

The binding posts on the cable terminals should be arranged in pairs, so that the two wires of a pair will be exactly opposite each other horizontally. This form is described in the report of the last Cable Conference. Its advantages are apparent at once. If a form of cable is used not requiring a permanent head, it may be connected directly to the lightning arrester binding posts in the order recommended above. We recommend, especially at the cable head, that nothing but lock-nut binding posts should be used.

The underground cable should extend from the subway to the fixture at which the terminal is placed, through a 3-inch iron pipe. These cables are [illegible] and enter

the office building in a great mass of ducts. At the point where they enter the office it is of especial importance that each cable should be available for handling at any time. It has been found that a symmetrical method of leading cables from any massed run into two vertical lines, hanging them on cable hooks attached to posts, or to the walls of the building, provides a plan whereby any one cable may be reached as desired. At each angle, or, indeed, at each point at which it is ever expected to reach and handle the cables, some such arrangement should be made. In many of the present large underground systems no provision has been made for this purpose. The cables have been pulled in indiscriminately, and no regular method of attachment has been provided. As a result, in what are purported to be drawing-in and drawing-out underground systems, it is even now becoming very difficult to do the work of drawing in, and wholly impossible to do the work of drawing out specific cables, without interrupting the whole system. This is apparently caused, first, by the very limited area of the underground manholes, and, second, by the failure to provide a comprehensive system, by means of which every one of the underground ducts may be utilized as desired.

In making a recommendation for a central office we are brought into consideration of the larger subject of the telephone building itself. This should be designed especially for the occupation of the operating switchboard and its necessary adjuncts. To that end, the building should first of all be fireproof. The operating office should be on the top floor. Provision should be made for leading the underground cables to a shaft of suitable dimensions, extending to a room which should be set apart for the terminals, distributing and testing purposes. Near to this should be a battery and power room of ample dimensions, providing for the generators, motors, main and testing batteries, with the necessary water connections and other appurtenances. The form of the operating room itself would, of course, depend largely upon local conditions. One of the chief requisites should be the anticipated ultimate capacity of the exchange. In general, if it is necessary to deflect the board from a straight line, it is better to have the operators work from the inside of a circle than around the outside, the arrangement being such that all operators are at once within view of the chief operator. The office should be free from elevator shafts or other obstructions, and should not be made a passageway for employés in reaching the roof or any other part of the building.

In view of the specific purposes of the telephone building, we think that, before plans are made for it, the telephone engineer, together with the architect, should definitely lay out the space to be occupied by the different departments which are to be devoted to the business, and especially their relation to the operating room, as it is almost impossible in a building already completed, or having plans laid out independent of this purpose, to arrange a telephone plant to the best advantage.

The underground cables extending to the operating office should be of the well known Conference standard, No. 18 B. & S. guage wires, twisted in pairs. At the central office end these cables should extend to a room just as near the operating office as possible, where they should be headed and connected to fusible arresters which will burn out with a current of half an ampère. From these arresters the circuits should be led by office cables twisted in pairs to the terminals of the distributing board, the opposite terminals of this board leading to the operating switchboard. This distributing board should be made in such form that wires may be led at any time from any point on the line terminals to any desired number on the switchboard terminals, it being so arranged that even when fully occupied all distributing wires are available for handling as desired. The distributing wires should be rubber covered, twisted in pairs and soldered at the connections. It is especially recommended that the cable heads be mounted on a fireproof fixture and that the distributing board be made fireproof.

When arranged in this manner the circuits are available for testing purposes at the fusible arresters, where they may be tested out through the underground cables or in through the distributing and operating switchboards. When an office is so arranged it is of advantage, therefore, that the testing should be done in this terminal and distributing room, and that this room should be accessible without passing through the operating room. The terminal and testing room should be in charge of the chief inspector, by whom all circuits would be tested, and who would have charge of the general trouble work of the exchange. There should be supplied for his use a telephone outfit, with connections to the office manager or chief operator; circuits through the operating board; a circuit to the generator and power tables, and also to plugs available at the cable heads, by means of which line or office tests may be made. He should have also a Morse outfit with relay and key, with a battery circuit included, and be supplied with a galvanometer outfit and a Wheatstone bridge.

While it is not recommended that at every exchange office there should be kept additional and more delicate instruments for making insulation resistance, or capacity tests, it is expected that in each company these appliances are available, and they may be connected for such tests through this chief inspector's apparatus.

In the operating room of the larger exchanges, we recommend that there be placed a multiple switchboard adapted for metallic circuits. This will extend, preferably, in one line at about four feet from the wall. The number of circuits terminating at each section of the board will largely depend upon the average daily use of the telephones in the exchange. Broadly, however, it may be stated that one operator will handle one hundred lines, if not burdened with the making of tickets or the handling of incoming local trunk wires. If branch offices exist in the exchange, the incoming trunk wires are preferably to be handled on the first one or two sections of the board, and the toll-line business preferably handled at the first section. At this section connections may be made requiring tickets or other records, such as checks on toll or long-distance business. If incoming trunks from a branch office are handled, they should be operated preferably by operators having, in connection with their telephones, a "talking circuit," its two branches extending "open" to the branch exchanges, so that calls received by these operators would be through his telephone. The trunk lines should be so arranged, however, that they may be operated by ringing calls in the usual manner if desired, without regard to the talking circuit.

At the subscribers' sections, three operators' outfits should be provided in the usual manner, excepting that double plugs, cords and ringing keys are used, and the talking circuit is bridged, not looped. The line circuits would extend through this board in the usual manner, the line and test wires being twisted together in pairs throughout the cables and operated as the two sides of the metallic circuits. After passing through the last multiple board, the circuits would extend through an intermediate distributing board, placed preferably immediately back of the multiple sections. At this board the circuits may be distributed to such answering jacks and drops as may be desired. These answering jacks and drops are arranged in front of each operator, the drop being of high resistance and retardation, preferably of what is now known as the tubular pattern, and bridged across the circuit which extends from it to the answering jack, where it is to open until a plug is inserted. By this arrangement, the line drop itself is used for the disconnection signal. The advantages of having the line and clearing out drops identical have been appreciated within the last two or three years, especially in the use of single-cord boards, in which type of board the work of clearing out and watching connections is probably better done than in any other. In a board so arranged it will be seen that when two metallic circuits are connected together all the advantages of a metallic circuit are preserved. In all cases grounded circuits extended to the exchange through metallic circuit cables should be connected to ground at the outer end of the cable, the unused wire of the pair being grounded at that point. Therefore, when a grounded circuit is connected to a metallic circuit by means of this return wire, the advantages of the metallic circuit are extended to the outer or grounded end of the cable, from which points of course, the single wire will be subject to such interferences as its exposure may bring into play. The return wire is by no means thrown away, but is thus utilized throughout the cable. When two grounded wires are connected together they are practically preserved from interferences from adjacent wires throughout the cables and the operating apparatus by the shield of the twisted mate, which is grounded at its extreme ends. As all of these wires enter the office in pairs, it is essential that the use of each wire of a pair should be distinguished throughout its entire length, and it should be provided that in the cables, as well as throughout the switchboard, the white wire be used for the line and the colored wire for the test.

With the extension of metallic circuits it is often asked how they may be utilized for the service of two or more subscribers on the same circuit. Probably the best results are accomplished by bridging the different instruments on to the two sides of the metallic circuit, using a ringer magnet at each instrument, of high resistance and retardation. By this arrangement the electrical balance is preserved, and no alteration in the ordinary form of operating apparatus is made necessary.

It has been the practice heretofore, to loop intermediate sets of instruments into a circuit. At first this practice was persisted in when metallic circuits were introduced, additional instruments being looped into the side of the circuit. Such an arrangement, however, destroys the balance, and the instrument so connected will be subject to disturbances as loud as the line is capable of producing, and it will also be a source of disturbance to the other instruments in the circuits. By connecting all instruments, however, in multiple arc, *i. e.*, bridging across the circuit, nothing is lost in transmission, if the coils have sufficient retardation and the electrical balance necessary to the proper working of the metallic circuit is preserved. Systems have also been devised whereby a third ringing wire is legged on to the metallic circuit extending through the ringer magnets of all the instruments. This wire is open when the telephone is removed from the hook. It seems that at the time this latter plan was thought of the successful results of the bridging-in system had not been appreciated. In a number of instances attempts have been made to eliminate disturbances on grounded wires from electric railways and electric lights, by the use of a common return wire. While this has been of advantage in some cases in connection with single wires, the common return has no advantage as forming a part of a metallic circuit, and its use in direct connection with a metallic circuit is not to be thought of.

With circuits arranged as detailed above, the entire central office and cable plant is provided against inductive interferences originating within their limits, and the exchange is in condition to be easily changed to a complete metallic system.

Of course, it is recognized that very many of our large exchanges equipped with multiple boards, are now wired only for grounded circuits, and are, therefore, not to be operated on the plan indicated. There are, however, at these exchanges demands for metallic circuits and instruments to be used for local and long-distance work. By their use advantages are obtained in largely overcoming local inductive interferences. Such circuits may be arranged advantageously on the plan of what is known as a combination loop. This is a local metallic circuit so arranged as to extend as a metallic circuit through the long-distance or metallic circuit switchboard, where one branch is grounded, the other branch extending in the ordinary manner as a single wire through the local exchange. Locally, the wire is handled in the usual manner. At the combination board, however, the circuit extends to two jacks, and is handled by means of a twin plug. If in combination with a multiple board, the jacks are so arranged as to provide the usual "busy" test when a plug is inserted. The circuit led by the twin plug and double cord at this combination should have all the advantages required for long-distance work. It is also found that in grounded circuit multiple boards very much of the induction which is occasioned by the old method of wiring may be overcome by using double plugs and cords, the outer shell of the plug being connected directly to the ground, by means of which the test ring is grounded independently of the line wire. During the transition period from grounded to metallic-circuit apparatus, therefore, we would recommend the use of the combination board, and of the double plug and cord in connection with a multiple switchboard. It might appear at first that by using double plugs and cords on a multiple board wired on the old plan, the apparatus throughout could be operated for metallic circuits. This, however, is not the case, as owing to the fact that the wires are not twisted in pairs, there is actually more induction between wires in the board when operated as metallic circuits than on the plan indicated for operating grounded circuits.

At many of the Eastern cities through which the main lines of the Long Distance Company pass, special metallic circuit switchboards have been placed for the purpose of handling these circuits and such local metallic circuits as were to be connected to them. In order to avoid all possible leakages or troubles in these boards, it has been thought advisable to connect each wire of the metallic circuit to a separate spring jack. These jacks are arranged in pairs and handled by means of a twin plug. This consists of two ordinary round plugs in one handle. Adjacent to this board is placed a testing board, through which the wires pass, and at which they may be handled for testing purposes in either direction. In connection with one or more of the local circuits on the board are placed repeating coils, which terminate in single lines in the local exchanges. The form of the repeating coils, and the method of connection, are now well known. In connection with these switchboards are the long distance metallic circuits.

In the building of these lines, probably more attention has been paid to the requirements of a high-class service than in any other existing plant. Their record in maintenance and in service performed during the past three years is too well known to need comment. It is of interest, however, to state that on the oldest of these extensions, being the line of 25 wires between New York and Philadelphia, there are probably to-day fewer interruptions than at any previous time, the line having shown absolutely no deterioration.

On these long-distance lines the problem of overcoming inductive interference from one circuit to another proved a very serious one. A system for so transposing the wires that no inductive interference exists between the pairs, was, however, devised, and has been reduced to practice.

In ordinary pole lines, where the wires are placed on cross arms 12 inches apart, it is found that the inductive interference between adjacent metallic circuits experienced in an exposure of one mile is not serious, using the present long-distance transmitter and hand telephone.

Adopting this as a basis, the systematic plan of transpositions provides that at distances of one mile the two branches of the metallic circuit on which the disturbing effect is experienced are so transposed that when the distant end of the line is reached, each branch of the circuit has had a like amount of exposure to the adjacent wires. When metallic circuits are arranged in this manner, inductive disturbances are entirely overcome. Where disturbances are caused by electric light or electric railway circuits, of course, transpositions must be made more frequently, as the amount of exposure which may be tolerated depends upon the intensity of the disturbing circuits. Transpositions have been best handled mechanically by the use of a special double transposition insulator recently devised for this purpose. This arrangement consists of two insulators, one being placed immediately above the other. The lower one has a hole through the top, and the pin extends up through it; the upper one is then threaded on to the top of the pin. In order that ordinary pins may be used, a threading tool has been devised by means of which any pin may be turned down to the desired dimensions. During construction in transposing, the left hand wire of a pair is brought around the upper insulator and then extended parallel with the cross-arm, back of and around the upper right hand insulator. The right-hand wire of the pair extends around the right-hand lower insulator along the arm and back of and around the left hand lower insulator. The wires are tied at each insulator in the usual manner. Where existing circuits are to be transposed, of course, the wires in either direction must be "dead ended" at the respective insulators, and it is then usual to make the transposition by means of a short piece of insulated wire drawn tightly across the two wires. Where a large number of wires are to be transposed, the plan of arranging them properly becomes more involved, and should be laid out by a competent telephone engineer.

If a metallic circuit for telephone purposes is constructed upon plans properly laid out, every particle of outside disturbance may be overcome and the services may be made perfect. Any falling away from the high standard of these plans, however, at once detracts from the results, and should not be tolerated.

It must not be thought that what we have called "The New Era in Telephony," the various details of which we have attempted to describe, is something entirely new. This is not the case. To-day it is a commercial factor for which the public is making loud demands. Many of our largest exchanges have been reconstructed tomeet the new requirements. New York, with a present office equipment for nearly ten thousand lines and nearly fifty miles of conference cable in circuit, is in the lead. In Buffalo and New Haven the entire exchange plants are being rearranged, while in Baltimore and in eleven New England cities, metallic circuit operating apparatus is shortly to be placed.

Although individual discoveries and inventions will undoubtedly lead to improvements in the detail of the appliances involved, yet we think that it will be by adhering to uniform practices, by a concerted action on the part of the companies taking up the new service, and a careful consideration of their experiences, that the greatest improvements may be looked for.

During the past very much has been lost by a lack of uniformity, and by the failure to find out and use what was really the best in appliances and general plans for the service. The methods of the East and the West have differed widely, and in some localities the business seems to have been run on the assumption that it was not there subject to the same electrical and natural laws as elsewhere. As a result there has been no fixed standard of telephone exchange service.

We have never heard of any exchange that its service was too good. This is, perhaps, owing to the nature of the business itself, and yet it is in spite of the very best efforts of telephone men and the liberal expenditure of money in providing what was thought to be best. There is probably no exchange to-day that does not represent what was thought to be the very best engineering at the date of its construction. In the light of modern development, however, we see in these existing plants too many wires in single cables, too small wire, rusted out plants of iron or steel wire, deterioration of insulation in outside or inside wiring, twenty different styles of battery in service, as testimonials of the dearly bought experiences of the past. We also see some exchanges overcrowded with operators, working as if the service was to be performed by the force of numbers. In some the benefits of modern appliances are lost because of the lack of proper utilization. One exchange, for example, shows you 300 subscribers' lines terminating on one section of multiple switchboard. In another you will find less than 100. It will not much overstate the case to say that in making plans for telephone exchanges, either the plans of similar establishments elsewhere have not been studied at all, or if they have been studied, the judgment of them has been so influenced by local conditions as to preclude their possible benefits. In this "new era," in

which a perfected service is to be given, such engineering cannot possibly be successful. Our companies are now unanimous in telling us that nothing is too good for the service. Unfortunately, to those in direct charge of the service, this statement means very little. What is needed is some source of information from which we may learn just exactly what is good for the service. May not this association, whose membership comprises all well-known experts and telephone engineers, keep posted in telephone matters in various localities, and determine, for our mutual benefit, the best practical plans for telephone work? Thus there might be furnished to the companies included in this association detailed plans covering every branch of the telephone service, by means of which we may raise the standard of workmanship in our employés, remedy as far as possible the effects of the loose methods of past years, and properly provide for the requirements of the future.

The new era in our business has dawned brightly; our patrons see and appreciate it; skillful engineering will provide for its needs, and eternal vigilance will preserve it.

After a brief discussion, part of which was on the point whether the paper should be published or not, the convention adjourned until 10 A. M. Wednesday.

WEDNESDAY'S SESSION.

The meeting was called to order at 10 A. M. in "executive session" with closed doors.

The following paper was then read from Mr. J. C. Reilly on

UNDERGROUND WORK IN BROOKLYN.

This statement of underground construction in Brooklyn is submitted in continuation of the papers upon the same subject by Mr. Sargent, read at the conventions held in 1886, 1887 and 1888.

Our actual underground extensions during the past year have been limited to about half a mile of conduit, the duct length of which is $1\frac{8}{10}$ miles, and to placing $1\frac{7}{10}$ miles of cable. In connection with the underground system, however, we have placed upon the elevated railroad structures $3\frac{7}{10}$ miles of cable, with $5\frac{8}{10}$ miles of distributing duct, and connected through this duct 553 subscribers. The completion of 17 miles of elevated railways throughout Brooklyn, upon which we have the right to place cables and wires, made any immediate extension of our underground conduits unnecessary.

Our present mileage of conduit, cables, etc., is as follows:

	Underground.	Elev. R. R.	Total.
Miles of conduit	15.8	5.3	21.1
Miles of duct	100.1	5.3	105.4
Miles of cable	24.3	13.7	38
Miles of conductor	2339.9	1294.7	3634.6
Miles of conductor working	1327.2	679.3	2006.5
No. of subs cont'd	2002	553	2557
No. of cables cont'd	44	15	59

Our method of distribution from underground cables by means of terminal poles or house-top fixtures, has been modified to a great extent by the facilities offered by the elevated railway. The method of distribution from the elevated railway structures is as follows:

Terminating either an underground cable or a cable placed upon the structure itself at some convenient point on the road, we run rubber-covered wires from that point in a distributing box, 6 inches square, which is placed along the footway between the tracks to the points opposite where it is desired to branch them off. The wires are then dropped through holes in the bottom of the box, run along the cross-girder of the road to the curb line and jumped directly into the subscribers' offices or to a branch pole line or housetop fixture. Where there is a group of subscribers in a block it is the practice to branch a cable containing 10 to 25 conductors from the main cable on the road to a convenient point in the block, and distribute over housetops from there.

We had decided to place some thirty miles of conference standard cable in our underground conduits and upon the elevated railroad structures during the year, but we were fortunate in perfecting and applying a very simple and effective method of transpositions, which enabled us to reduce our cable purchases one-half. This was foreshadowed by Mr. Sargent in the following paragraph, read at the convention held at New York in September, 1888:

"The transition period between grounded and metallic circuit systems will be very troublesome and annoying, and may last for several years. It is our intention, in ordering the type of cable just described, to make provision in the manholes for joining the sections together by devices which will enable the joints to be opened readily without cutting the cable and the pairs broken up in order to prevent cross-talk on grounded circuits, and at the same time allow of access to them for straightening them through when twisted metallic circuits are required. The necessity of getting at the joints in this way from time to time, and the space required to accommodate connecting boxes, is another argument in favor of large and commodious manholes."

As the results obtained may interest the members, it might be well to state that four cables of the conference standard type,

Number 1—3,000′ Number 3—6,655′
Number 2—5,310′ Number 4—7,500′,

were connected up and in use by subscribers, the twin wire in each case being grounded. Requiring additional conductors to the points reached by the cables 1 and 2, we attempted to use a number of twin wires for subscribers. After one week's trial we were compelled to reach these points by other routes, and cut out of the cables on account of complaint from subscribers of constant cross-talk. We then, during several succeeding Sundays, introduced transposition plates at splices from 500 to 700 feet apart and connected the subscribers through, using the wires indiscriminately. Cables 3 and 4 were transposed in like manner, and we are using from 60 to 92 conductors in these cables for subscribers, and there is even on the largest length, 7,500 feet (with 92 wires working), but very little cross-talk noticeable at any time. Other cables connected in the same way since February last give like results. In each cable a number of circuits are connected straight metallic to provide for trunks and metallic circuit subscribers.

The transpositions are made upon hard rubber plates three and a half inches wide by seventeen long, fitted with spring contacts, and attached to a similar plate to which the conductors of the cable sections are connected, and the whole inclosed in a copper box. The lid of the box can be easily removed when it is desired to restore the pairs of the cable, which is done by substituting for the transposition plate another plate, connected regularly in pairs.

Close observation of the creosoted conduit and the lead-covered cables laid at various times since 1884, seems to prove that the destructive agent usually present in freshly creosoted wood, disappears almost entirely after a few years.

A Western Electric cable, purchased in 1886 and placed in the 1884 conduit during 1887, over two years ago, shows but very slight trace of action on its surface at this date, while part of the same cable laid in the 1888 conduit shows quite a scale of carbonate of lead after one year's exposure. Parts of the same cable placed in other conduits about a year after their construction show but little damage on the surface.

A Western Electric cable placed by the Metropolitan Company late in 1885 in a creosoted conduit between the Brooklyn central office and the Brooklyn Bridge, when examined a few days since after three and a half years' exposure, shows a slight crust of carbonate, principally on the upper part. A New York & New Jersey cable laid in the same conduit in 1886 is in the same condition. We do not anticipate the loss of either of these cables from the action of gases. To further test the effect of time and ventilation on creosoted wood we placed samples of the Western Electric and New York & New Jersey cables covered with the alloy of lead and tin, in a box made of creosoted wood which had been in the yard for two years or more, and samples of same cables in a box made of creosoted wood which had been on hand about eight months. After being sealed up for three months the boxes were opened and the samples in the old wood box were found to have but infrequent patches of what is known chemically as phenolate, while the samples in the box made of the later lot of wood were thickly covered on the sides and top by phenolate. Either phenol, a volatile gas, or acetic acid in combination with carbonic acid gas will reduce lead to carbonate of lead. There being no acetic acid in the wood properly treated with dead oil of coal tar, and the phenol escaping by evaporation and ventilation, the carbonic acid gas present will, in all probability, have no more effect on the lead covering than if the cables placed were in ducts of iron or other material. It would seem desirable, therefore, before placing creosoted conduits underground to expose them to the air or to artificial means for evaporating the phenol from the creosote, if the latter cannot be obtained free from it. There seems to be no doubt as to the durability of creosoted wood. Frequent examinations during the past five years show there is no decay of the wood or change of any kind to cause injury in placing or removing cables. Its economy, flexibility and safety strongly recommend its use for conduits.

Our examination of the cables in use seems to show that there is a difference in the alloy covering. The Western Electric cable, covered with the alloy of lead and tin placed January, 1885, in a conduit completed the previous month is, to all appearances, in as good a condition as when first laid, nearly five years ago. It will be remembered the cables covered with pure lead were destroyed and removed from this conduit.

A Western Electric cable supposed to be covered with the same alloy, purchased in 1886 and placed in the conduit in 1887, with cable referred to above, shows a slight trace of carbonate, while part of the same cable placed in a newly-laid conduit is severely attacked, as stated in remarks on conduits. The cable first referred to above is, in fact, the only one we have which can be said to show no action on its surface. We are now having chemical test made on specimens of several cables, to determine, if possible, the difference in their composition.

The practice of ventilating the conduits and manholes, as they are constructed, by lateral branches to poles and housetops, and to which we ascribe our freedom from explosions, has been extended considerably during the past year by placing three-inch iron pipes from manholes to the columns of the elevated railroad, which serve the double purpose of ducts and ventilators. The quantity of gas in conduits and manholes has been sensibly reduced, and in two instances where conduits entered central office basement, the odor of gas, which it seemed impossible to entirely exclude, disappeared entirely after the manholes outside were connected to the E. R. R. structure by a number of three-inch iron pipes. A large tube, leading to a dead chimney at this office, in connection with pipes to elevated railroad near by, usually keeps the large tunnel through which the conduits enter the building pretty free from gas.

We believe ventilation of this kind is the easiest and best method of preventing the explosions in manholes occasionally reported from other cities.

Experience confirms our belief that manholes should be made large and roomy, with hooks or guides on the sides, where cables and junction boxes may be arranged out of the way of workmen engaged in drawing cables in and out.

Except the cables removed on account of destruction of the lead covering, we have had no special trouble with either cables or terminals, and the electrical condition of our cables remains practically as reported last year. All cables connected during this year give satisfactory results in insulation and capacity.

Mr. Flemon Drake then read the following paper on

SWITCHBOARDS AND LONG-DISTANCE LINES ON GROUNDED CIRCUITS.

The secretary of this association has asked me to submit some observations covering the experience of our company with switchboards and also with long-distance telephone lines on grounded circuits. Such a thing as writing a formal paper to be read before the association, that will interest its members, is beyond my capacity. I should dread disappointing the expectations of those who suggested it, but such information upon the subjects of switchboards and long-distance grounded circuits as my experience affords will be gladly placed at your command.

I think it is settled beyond all controversy that a cord and plug board, of convenient size and construction, is the best, by all odds. The more simple such are in construction and mechanism, the better. We have in use in our smaller exchanges a very compact, simple affair: a strip of wood upon which are arranged ten metal plugs, or points, a little less than one-fourth of an inch in diameter, and about an inch and one-fourth long. These have a shoulder resting on the front side of the strip, with screw and washer holding them at the back. Just above this, passing through the wood, is also placed a spring similar to those in the Western Electric spring jacks.

This is fastened to the back of the strip, bends down in contact with the plug or pins at about three-quarters of an inch from the face of the strip. A hollow plug with rubber shield attached to cord makes the connection in the usual manner. These strips are fastened on to the switchboard frame, the same as any other strip for spring jacks would be, in rows of ten, thereby constructing a 50 or 100-wire switchboard, as desired. A false face of wood, fibre or rubber, with holes at proper places to give access to the hollow plug in connecting with the spring jack, is placed over the hole and the subscriber's number stamped in the proper place. Any suitable annunciator can be used. This arrangement gives us a board very compact and convenient for access to all its parts.

This company has only one multiple switch-board in use, that at Omaha. This is the Western Electric board, constructed in all respects the same as others, except in the matter of clearing out drops. Owing to the system prevailing here, of each subscriber himself ringing the party he desires to talk with, it was desirable to have a drop which could be made to signal the central office or not, at the will of the subscriber. In the place of the ordinary clearing out drop we therefore substituted a galvanometer drop, a permanent magnet suspended inside a coil which vibrates only slightly under the influence of the generator current. On the generator is a special commutator which is put into circuit by the subscriber pressing a button at the same time he turns the crank of his bell. This operation throws the current upon the line, affecting the galvanometer drop to such a degree as to tip the catch of the shutter, at the same time giving nothing more than one click on the bell of the subscriber with whom he may be connected. This arrangement and system has worked very satisfactorily indeed. It gives the operator less work, enabling her to handle subscribers more rapidly than if she is delayed by ringing up those who are called for. I know that it is claimed by many that it is the duty of the telephone company to do all that is necessary to get the two subscribers to talking, but our experience seems to indicate to us clearly that subscribers are better satisfied if they get the connection promptly and are given the opportunity of doing the calling. It occupies their mind; the time of waiting is thereby shortened (to them), and when the party does not answer they seem better satisfied. These observations are confirmed by the reports of those who have used other systems in other cities. So far as I know, these reports are invariably favorable to our system. It is also claimed that the ringing done by the subscriber invariably wears out the machinery more rapidly. Ours has been in use a little over two years, and we have had no more than the ordinary troubles so far. I do not see why it is not as easy to construct a bell that will last indefinitely, as far as the wear is concerned, as it is to construct a dynamo that will run for years.

Regarding the subject mentioned in the secretary's letter—long distance lines on grounded circuits—I will say that while our success has, perhaps, in some respects, been above the average, I am decidedly of the opinion, nevertheless, that we will find it desirable to adopt metallic circuits for all routes extending 100 miles or more. From Omaha we have circuits reaching to the following points: Columbus, 90 miles; York, 129 miles; Sutton, 145 and Fairbury, 135 miles. The circuit to Sutton is wholly hard drawn copper wire, weighing 213 pounds to the mile. The others are mixed circuits, iron and copper. We daily do business between subscribers over these circuits. Of course, in summer we experience more or less difficulty from atmospheric disturbances, and in the evening there is sometimes disturbance on account of electric light plants in the different towns through which we pass. Upon an average, one-half of the communications between these points are made direct between the subscribers, without the assistance of the operators.

Notwithstanding this showing, I am satisfied that it would be better for ourselves and our customers that we make each of these a metal circuit and work it as such. Our business could easily be increased fifty per cent. thereby. In considering the economic phase of long-grounded circuits, I am fully satisfied that no telephone company is justified in making a low rate for long distances; that there is much more profit in working a short circuit at a low rate and charging a good stiff rate whenever the circuit of 60 miles and over is used.

If it should appear from this statement that we have a greater degree of success in working our circuits than is obtained in the East, I would attribute it, I think, to our comparative freedom from the disturbing influences of other lines—of the telegraph, motor, power and electric light. Without a doubt the proximity of earth circuits has a marked effect. As an illustration, I may mention that we talk as well ordinarily from Columbus to York, by way of Omaha, as we can from either York or Columbus to Omaha alone. That you may comprehend the peculiarity that I mention I will state that both towns are nearly west of Omaha, Columbus, 90 miles and York, 129 miles by wire, and the latter about 50 miles south of Columbus. The wire to York makes a detour to the south through Lincoln, which adds to its length. Practically, York and Columbus are the two ends of an ox bow and Omaha in the middle of the bow, when the lines are connected together.

We are extending our system and probably by the time of the assembling of another convention, we shall be attempting to work a copper-grounded circuit, Omaha to Kearney, 210 miles.

Mr. R. M. Bailey then read the following paper on

TELEPHONE SALUTATIONS.

With the idea that successful telephone service depends on the aggregate of many small details, I have written the following with the hope that some one of the many practical persons among you may present a remedy for the points of defect noted:

It has been customary in all ages of the world, when persons meet, that salutations more or less elaborate and courteous be exchanged, and the peculiarities of different peoples in this respect have been a fruitful source from which many writers and lecturers have drawn.

On the advent of the telephone the want was immediately felt for some form of salutation which should have the effect of attracting the attention of the party at the distant station, so that conversation might readily pass between the telephone correspondents attempting it. Some bright genius suggested the word "hello," which, by the way, is not usually approved as a proper salutation in polite society, but which, for telephone purposes was at once generally adopted, the word having the apparent faculty of being spoken over a circuit utterly incapable of transmitting any other word in the English language; and while the word *may* be the one of all others most suitable for telephone purposes, its use has developed into most annoying abuse. With intelligent people, as well as with others not so intelligent, and with telephone experts in a great measure, it is customary to stand at one end of a telephone line and by reiterating the word a great number

of times in quick succession, entirely drown out the fellow's voice from the other end of the line, and he, by going through a similar formula with energy and patience frequently mixed with anathemas against the telephone, succeeds in slowly getting into actual conversation, while the fault lies entirely with the individuals and not with the innocent machine. What would be thought of a person entering an office or premises of any kind, knowing and seeing the proprietor there present, should he begin and persist in calling attention by repeating over and over again the word "hello?"

In some mysterious manner the human intelligence is capable, if the person chooses to exercise the faculty, of recognizing the presence or absence of his correspondent at the distant end of the line. Telegraph operators are familiar with this consciousness; and by the use of a little good judgment people may save themselves the wear and annoyance of "helloing" into the earth for some time before the other fellow is ready to respond.

"Good morning," or some similar salutation, should be more agreeable, and, it being more deliberate, has the advantage of giving the opportunity for a reply to flow over the wire without interruption; and if the conditions referred to are observed, should be ample to start two reasonable people into prompt conversation, taking into consideration the general high state of efficiency in which telephone lines and apparatus are at this time maintained.

It is really wonderful how easy and pleasant an undertaking it is to converse over a properly-conducted telephone line, and it is wonderful the amount of vexation one can cause for oneself, if persisting in the manner before referred to. Some people are strongly averse to the use of a telephone for no other reason than want of judgment and training in its manipulation. It may be said that such difficulty is the result of habit superinduced by inferior telephone service in the past, and want of familiarity with its operation, so that all such subscribers are compelled to first test out their lines before proceeding with the business in hand. I think such causes, at this time, rarely exist, and may not the habit be broken by some improvement in the system, and by courteous and careful schooling to the end that more rapid, pleasant and agreeable service be secured, to the happiness of the customer and employé as well? Certainly much more time is used in worthless preliminaries than in the actual service. Some rule as to the introductory is badly needed in the operation of the telephone. Sometimes subscribers call up a central office and inquire who called them or who it was who was talking to them a little while since, and then think it singular that the operator, in the multiplicity of her calls, should be unable to give the desired information. Again, a person calling for another is naturally desirous of being assured that he is speaking to the person he has asked for, and a person called up is naturally reluctant in answering an inquiry until one or both are satisfied of the identity of the other. All this leads to questioning on both sides, and much valuable time is thus consumed. Would it not be a good plan for each of the correspondents to announce his name or the name of his firm as the only preliminary, thus abandoning both "hello" and "who is talking?" Would not self introduction obviate this?

The rapidly repeated ringing of call bells, although not properly coming under the head of telephone salutations, may as well be considered in this connection, and is certainly an evil of the service which should be abated, it being worse than useless in that it, like steam whistles, when much indulged in, breeds contempt and carelessness as to prompt replies or observance. Switchboard operators should be prohibited from calling more than three times, spacing the calls sufficiently to allow the subscriber to arise from his chair and reach his telephone; while subscribers should have it impressed upon them unceasingly, when so addicted, that rapidly repeated calls are a hindrance to prompt service.

Mr. Crandall, of New Orleans, then read the following paper for Mr. E. H. McFall:

DYNAMO ALTERNATING CURRENT INTERFERENCE WITH TELEPHONE SYSTEM IN NEW ORLEANS, LA.

This paper is intended to suggest to the practical ideas in this convention some of the interferences set up by alternating currents. I will first give the relative positions of the respective routes in question. The telephone route in illustration is one with which we are having the maximum amount of trouble, and that is paralleled by the electric company's main route (alternating) on opposite sides of the same street, and carrying six circuits to a considerable distance of parallelism, and at the immediate head, eight circuits of 1,000 volts each. The extreme distance of parallelism is 6,600 feet, with a separation of 43 feet or width of a street intervening from pole to pole of systems, the telephone poles being the highest, having an elevation at the lowest wire of about uniformly 10 feet above the electric light wires.

When the first alternating current was put in operation along this route a decided hum and a musical note were heard in all of the telephone lines in this parallel distribution. This hum was of sufficient volume to make an attempt to carry on a telephonic conversation on any of these lines extremely difficult and doubtful. By the time the subscribers became accustomed to this disturbance the second circuit was put in operation, and another, and so on until six were in full blast. The humming sound then ceased to be musical and assumed proportions of an undulatory waul, impenetrable to the deflections of the transmitter, and at times would swell in volume and graduate to a uniformity of disturbance about equal to that set up by the first circuit. This does not occur, however, at regular intervals, and becomes noticeable visually in the increase and decrease of the incandescent light service through this system, showing that the currents were interfering with each other.

To the electric light companies this interference became a serious question, and to a great extent was remedied by placing the wires of each respective circuit nearer each other and farther from other circuits. To the telephone subscribers and exchange the hum is still there, strong and vigorous as ever. On this route we, the telephone company, tried the return ground, covering the field of interference, but not entirely back to the exchange. The ground was located at a neutral point and gave some considerable relief, but not entirely, to the subscribers connected. We are also subjected to another cause of interference set up by the same electrical dynastic imperialist. I refer to the leakage, causing a frying, variable, hissing sound, alarming in its objectionable effect upon the sensitive ear, and that is contributive to a larger extent within the territory of distribution of all alternating systems, where the consequences of grounded circuits are increased by the use of converters in their frequently exposed liability to precipitate moisture, or as carelessly located, in influences contributive.

It is doubtful if another license has been subjected to the same extent of interference, and the physical facts afflicting us above are presented to your attention for such discussions and opinions I trust, that will direct to a remedy other than compromise.

The convention then adjourned until 7.30 P. M.

At the evening session on Wednesday, a letter was read from Mr. C. A. Brown, asking co-operation with the National Electric Light Association in removing the duty on copper. Some of the members were very nervous, however, about the result of such a movement if they took part in it, and the question was dropped without being brought to a vote.

Mr. McCluer, of Richmond, brought up the subject of induction on telephone circuits from power wires, but very little new information was brought out, except to show that the matter is still one of controversy and "dicker" between the various companies affected in different communities.

On motion of Mr. E. J. Hall, Jr., the secretary was instructed to send the cordial thanks of the association to the following: The North Western Telephone Exchange Company, the State Agricultural Society of Minnesota, Minnesota Brush Electrical Company, Messrs. C. A. Pillsbury & Co., North American Telegraph and Postal Telegraph Companies, Western Union Telegraph Company, Chicago Electrical Club, Chicago Telephone Company, Central Union Telephone Company.

On selecting the place for the next meeting, several places were suggested. Detroit, Buffalo, Old Point Comfort and New Orleans, and were discussed by Mr. Crandall, Mr. Carson, Mr. E. J. Hall, Sr., Mr. E. J. Hall, Jr., Mr. Eastabrook, Mr. Metzger, Mr. Wiley Smith and others, and upon vote Detroit was chosen as the place for next year.

Mr. W. D. Sargent then read the following

REMARKS ON THE TELEPHONE EXHIBIT AT PARIS.

It was my good fortune to be selected by the American Bell Telephone Company to take charge of their exhibit at the Exposition Universelle, Paris. My duties in that connection required me to remain in Paris about two months, during which I spent most of the time at the Exposition, afterward making a flying trip through Switzerland, Germany, Belgium and England.

The exhibit on the part of the American Bell Company consisted:

First: Of an historical exhibit, comprising originals and models of the first instruments conceived by Professor Bell, down to the present forms.

Second: Of the most improved form of long-distance desk transmitters and metallic circuit switchboards, together with samples of cables, call bells and other apparatus; also a large pole, complete with cross-arms, braces, etc., typical of the best form of line construction in this country at the present day. Wires were run from our space in the industrial section of the United States to connect the various offices and departments of the United States Commission. All these wires were run overhead on the buildings and centred in a switchboard where an operator was stationed to make the necessary connections. This system proved of great service to the commissioners, and was the only active part of our exhibit.

Outside of the telephone exhibit, the only electrical exhibits in the United States section were those of the Western Electric Company, embracing general electrical goods; Prof. Elihu Thomson, the Elektron Manufacturing Company, the C. & C. Motor Company, the Okonite Manufacturing Company, the Consolidated Electrical Subway Company, of New York, and the Cobb Wire Company. Prof. Abdank-Abakanowicz was in charge of the United States exhibit, and was particularly efficient in arranging the space and looking after the interests of exhibitors. The rest of the electrical exhibit was in Machinery Hall, being principally in the line of light and power, although there were many forms of burglar alarms, electric bell installations, speaking-tubes, telephones, etc. Mr. Edison, who occupied the largest space of any single exhibitor, showed all his various inventions with which we are familiar in this country.

The telephone business in Paris, so far as the Central Office is concerned, is conducted practically the same as in this country, but all their wires, as is well known, are underground in the extensive sewer system for which the city is noted. This sewer system affords an easy solution of the underground problem, but as it has been described to this association before, it needs no further description at my hands.

In all the cities where I stopped long enough to make any observations, I found the telephone wires universally overhead, the housetop construction being very much superior to anything we have in this country. The roof fixtures are made of light iron, carrying a very small phosphor bronze wire, so that large masses of wire are scarcely visible, and the fixtures themselves are so light and airy that to the eyes of a telephone man they are ornamental rather than otherwise.

I did not notice the use of overhead cables to any great extent, except in London, where the telephone system is entirely overhead and the construction is of much the same character as in the European cities, except that they use overhead cables. In Trafalgar Square a large lead cable is stretched across one side of the square, in full view from all points, and wherever you may look up in the heart of London you will see wires and cables extending in all directions.

The British Postal Telegraph Department put all their wires underground, and as they do a limited amount of telephone business their telephone wires are underground. Their method has been described before, and consists in drawing gutta percha wires into three and four inch iron pipes laid directly under the pavement, just inside the curb, or between the curb and house line, with manholes or hand holes at convenient intervals.

I could not learn from any of the electrical people that I met abroad that any plans had been made for a general system for placing a telephone exchange system underground.

Several other members of the association have been abroad this year, and will doubtless be prepared to give you the benefit of their observations. My own impression is that we have little or nothing to learn abroad, and that it will not be very long before the requirements of the business in London and other large cities will necessitate their placing their wires underground, and that we will be able to teach them many things when that time comes.

For several years I have been reporting to this association the progress of the underground work in Brooklyn; these papers will be continued this year by Mr. J. C. Reilly, the General Superintendent of the N. Y. & N. J. Telephone Company, to whom the credit of the very successful work in Brooklyn is in a very large measure due.

A little over a year ago our largest central office in Brooklyn was equipped with the single wire multiple board, and I have brought here the results of thirteen months' experience with the board, together with tabulated statements and remarks and conclusions by Mr. George J. Davison, manager of our Brooklyn office, who has made the subject a study, and which I will now proceed to read.

THE SINGLE WIRE MULTIPLE BOARD IN BROOKLYN.

W. D. Sargent, Esq., General Manager:

Dear Sir: In making a report to you of the workings of our new switch, it might, perhaps, be well to go back some years and recall the circumstances which led to its adoption.

The exchange was opened in 1879 at No. 4 Court street, removed in 1880 to 397 Fulton street, with 52 subscribers connected, being then operated by the Chinnock system, which was changed in 1882 to the so-called Western Electric Standard, section after section of which was added as needed by the increase in subscribers, until at the time of the purchase by this company of the property at 16 Smith street, there were in use sixteen 100-wire sections of mixed subscribers' and trunk lines and five sections of purely trunk lines.

The switch, battered and worn after six years' service, was not adapted for the proper care of so large a number of subscribers as had eventually been connected, nor in keeping with the company's new building, which was to be fitted up with the best appliances in all respects. The single cord Western Electric multiple board was selected in the belief that it was the best then devised, the most rapid, and the one with which the operators could handle the maximum number of calls.

The switch was ordered in nine sections, of which five were for subscribers' lines, only one subscriber on each line. The trunk lines were in sections by themselves, while the pay station lines and the circuit line (that is those on which were two or more subscribers), with any others which required special calls, or are in any way outside of the regular order, were also put by themselves. This arrangement of the switch was in accordance with your belief that this was the proper disposition to make of the various circuits, so that the direct or single wire subscriber operators should be entirely free from having to make any connections other than those that were local, and thus be enabled to give more rapid and better service, and also to determine the maxium rapidity of this form of switchboard. The experience gained in the use of this switch has demonstrated the advantages of classifying the business.

One of the direct subscribers' sections was equipped with double cords, but with the same looping in and ringing device as on the single cord sections. This modification of the general plan was made because the section so modified was in an angle of the operating room, and it was impracticable to put the full complement of single cord equipment in the reduced key-board space, and it was also felt that it would be desirable to have one section of double cords, not only as a relief or emergency section, but also for the purpose of comparison as to the respective merits of the two systems.

During April, May and June, 1888, the switch was put into position, all subscribers' and trunk lines were connected into it, and everything being in readiness, at midnight, Saturday, June 30, 1888, we cut away from our old switchboard and removed into the new quarters.

There were 1,476 wires connected with our switch at the time of removal, besides about one hundred private lines (switch lines, etc.), which come into the distribution room for test or other purposes, making nearly 1,600 wires to be transferred. On Sunday we handled almost the usual volume of Sunday business without serious friction. At morning test on Monday there were but 76 wires which were not in working order, and these were so nearly cleared up during the day that by Tuesday morning our test showed very little over the general average of wires not working.

In accordance with your instructions, a record was made up of all troubles arising in the working of the switch at the time of their occurence, and from these records I have compiled and hand you herewith, a tabulated statement showing the number of difficulties arising each month and the particular part of the equipment in which such troubles were developed, and will endeavor to point out the cause and possible remedy for some of them.

As shown by this table, during the thirteen months' use from July 1, 1888, to Aug. 1, 1889, the switch and its equipment have required attention on 1,115 occasions. Of this number 275 were confined to the cords, the balance of 840 being entirely in connection with what may be termed the fixed mechanical parts of the switch.

These 840 difficulties occurred in the various parts of the equipment as follows:

Spring jacks	11
Drops	294
Combination keys	459
Grounding jacks	76

The trouble in each of these parts has been classified in the accompanying table, so as to show as nearly as possible just where each occurred and, consequently, where the principal weakness lies.

Spring Jacks.

The spring jacks are what is known as the "Boston type," and there are 15,660 in use, all of which are set horizontally in the switch. The troubles with this part of the switch have been only eleven, ten of which were failures to close the line on withdrawal of the plug, and one, a loosened wire where soldered into the jack. The first were readily located and easily remedied, the difficulties being particles of dust or other matter at point of contact, which the insertion of a "jack cleaner" removed. The loosened wire was re-soldered with little difficulty. The use of platinum contacts instead of the present ones of German silver and brass, is the only suggestion of improvement which I can make for the spring jacks. It should not be forgotten that this is the first thirteen months' use of the switch, and that the trouble at this point must be a growing one, and therefore all should be done that is possible to do to guard against it.

Drops.

The drops used, both for subscribers' and trunk lines, are of the Warner pattern, and 1,660 are in use, 294 having re-

quired attention. Over 80 per cent. of all trouble with this part of the apparatus was developed in the first two months the switch was in use. The troubles are classified as follows: With the catch, 26; shutter, 36; armature trunnion, 203; crossed with core, 6; open in coil, 2; burned out, 1; broken wires, 20.

The "catch troubles" were trivial in their nature and easily remedied, requiring no more than a slight bending of the catch in the proper direction. The shutter troubles were caused by the shutter being too flat, so that it rested close against the face of the drop, and hence failed to fall when released by the catch. This failure was due to two causes, that is, air pressure and the centre of gravity falling directly over, or inside of the hinge. The remedy was bending the shutter outward from the face. A slight modification of the form of the shutter in this respect would be advisable.

The "armature trunnion" troubles were caused by a slight rusting of the iron bearings, caused by dampness, and were principally developed in August, 1888, when 190 required attention. The substitution of some metal other than iron at the point of bearing would very greatly reduce this difficulty.

The "crossed with core" was caused by abrasion of the insulation. The "open in coil" and "burned out" do not require any special mention, nor do the "broken wires," which were generally the result of lowering the drop shelves for other repairs.

Combination Keys.

Of the combination keys 1,560 are in use and 459 have required attention. Troubles are classified as follows: Operators' spring on line, 25; anglepiece loose, 10; cutting out and failing to close in line circuit, 197; operators' circuit not closing, 44; rubber plunger broken, 8; operator "cannot cut out," 118; broken wires, 57.

"Operators' spring on line" is caused by a loosening of the nut which holds the parts in position, and which could be avoided by slight changes in construction. This is an especially annoying trouble when it occurs at a busy hour, inasmuch as it short-circuits the operator's instrument and all connections for at least 100 subscribers must be made by adjacent operators, by the use of "helpers," and at a serious disadvantage.

"Angle-piece loose," refers to the angle-piece on the under part of the key, and which is a part of the main line circuit. Trouble arises from the loosening of the screw holding it in position.

"Cutting out or failing to close main line contact," has reference to trouble at point of contact between the angle-piece just mentioned and the main part of the key. This is the most serious of any of the troubles which have arisen in any part of the switch. None of it appeared for the first nine months, while in the last four months 197 keys had to be attended to—an average of fifty per month. The trouble so far has been almost entirely confined to the trunk line and double cord section keys, these being used more frequently than a subscriber's key, but there can be no doubt that it is only a matter of time when it will spread throughout the entire key-board. The contact where trouble occurs is only a pressure contact and between German silver and brass. The brass is in the form of a small rounded knob, which becomes covered with a black deposit, either from corrosion, dust or other cause. This does not entirely open the line (the generator current never failing to pass through it), but it forms almost a complete barrier to the passage of the telephonic current. An especially bad feature of this trouble is that it is not necessarily apparent to the operator, who, when she cuts in, hears the subscriber through another connection, and while she remains in on the connection (in all probability with her hand on the key adding additional pressure, and firmly making the contact), the subscribers may talk without any trouble. She no sooner cuts out, however, than the trouble begins. The voices die away, the subscriber rings, the generator current passes the obstructed point, and for a moment or so conversation goes on, only to be again interrupted as the operator jars the key-board by manipulation of adjacent keys. The trouble can be reached only by raising the strip of keys out of the key-board, taking the one in trouble entirely apart and polishing the points, or more correctly, the parts where the trouble is. Of the difficulty in doing this I shall speak more hereafter. The trouble would, I think, be greatly lessened by the use of platinum contacts, but the conformation at this point is especially bad, and I do not believe that any substitution of metals, while retaining the present shape, would entirely remedy the evil. The contact is not a sufficiently positive one; it is at best dependent entirely on the tension of the spring of the key proper, and is liable to be interferred with at all times by the operator's hands and arms as they work.

"Operator's circuit not closing." This trouble arises from dust accumulation and is easily remedied, except so far as the raising of the key strips is concerned.

"Operators cannot cut out." In these cases, the iron rod of the plunger becomes completely or partially stuck, so that the operator cannot manipulate it. Remedy, a touch of oil, or filing. The broken wires in the case of the combination key, as in all the others, is due almost entirely to breakage while making repairs.

Grounding Jacks.

There are 1,440 of these in use, 76 of which required attention. The troubles arising were: Test crossed with line, 8; operator's connection crossed, 5; line spring weak, 17; operator's connection not closing, dirt accumulation, 3; broken wires, 43.

The first three classes were all due to one cause, namely: the loosening of the screw at the base of the line spring, which allowed one or other of the parts to get out of position, thus causing the trouble. These screws are short and screw into hard rubber, and an effort to set them firmly is likely to result in the stripping of the thread and leaving matters worse than before. The line and test springs, too, do not fit into the rubber as closely as they should, which would otherwise prevent their getting out of position, even though the screw was loosened.

"Operator's connection not closing on account of dust" was easily cleared.

"Broken wire" due to cause heretofore noted.

Cords.

There are 1,480 cords in use, of which 280 are on trunk and double cord sections. Of the subscribers' cords but eight have failed, while of the trunk and double cord sections 170 had to be repaired. The explanation of this great difference in favor of the subscribers' cords is that a subscriber's cord is used only to complete those connections for which he may call, while on a trunk or double cord section each cord may be used any number of times.

One of the "operator's helpers' cords" is furnished each operator for the purpose of answering a subscriber instead of doing so in the regular way. Like the trunk and double sections cords, they show the effect of frequent use.

The failure in all of these was just at the base of the plug, and was due almost entirely to wear and tear, it being hastened, however, in a good many cases, particularly in the "helper" cords, by the rusting of the iron wire, caused presumably by the moisture of the operator's hands penetrating the cotton covering.

The failure in the telephone cords was always at the point of connection with the tip. The failure of the transmitter cords was due, I think, almost entirely to their passage through the pulleys of their supports. The transmitters in use are the "skeleton," with counterpoise weights in the rear of the switch. While these transmitters are more liable to get out of order than when inclosed, they are also more easily adjusted, and, being smaller, the view of the switch is less obstructed, and they can be put out of the way when not in use, and on the whole are preferable.

The sections of our switch are 6 feet 3 inches in width, with an actual key-board space of 70 × 9 inches. Within this space, on subscribers' sections, are placed 300 combination keys and 300 grounding jacks, through each of which a weighted cord is passed. On each combination key and grounding jack are soldered three wires, making in all 1,800 wires under the key-board of each section. To make repairs to the grounding jacks is not an easy task, but when it becomes necessary to take a combination key apart to clean it, it is a serious matter.

To do this, the strip of twenty keys, of which the troubled one is a part, must be lifted completely out of the key-board, which is particularly difficult on account of the necessarily short fanning of the wire cables. After repairing and replacing the keys it will not infrequently be found that one or more of the wires have been broken, and which it may require half an hour's struggle to replace. In the resoldering of such broken wires it is almost an impossibility to so dispose of the wires and cords as to permit the insertion of the hot iron, without at least scorching some of the cotton insulation. That such breakages, scorchings, etc., etc., will eventually produce a bad state of affairs is readily apparent.

Among the advantages of the single cord system are the fewer motions necessary and the consequent speed with which a call may be secured and completed: the 50 per cent. reduction in the number of cords necessary to complete a given number of connections, and the calling subscribers' drop being left in circuit makes the "ringing off" as prominent as a "call," and the operator's attention is not divided between two sets of drops.

I think each operator on the single cord system should be furnished with a few pairs of double cords. With these she could complete connections for operators on either side of her in case of a sudden rush or failure of instruments. She could make connections for those of her own subscribers whose cords were found to be out of order, and, in addition, use these extras at night, instead of going to the switch where a call is received.

Among the disadvantages of the single cord system are: The multiplicity of soldered wire connections; the defects pointed out in the key-board, especially in the combination key; the delays and annoyances to operators and subscribers in making repairs to key-board; the necessity of the calling subscriber remaining with the receiver to his ear until the desired connection is had or the operator's report received, there being no facilities provided for ringing back to the calling subscriber, and because all calls must be answered and the connections completed at the section of the switch where they originate. This objection becomes a serious one when there is trouble on any operator's instrument connections in the key-board.

The smallest number of subscribers that it is possible for us to put on any operator's instrument is one hundred. Trouble arising with an instrument, the operator on either side must attend to this operator's work, which can only be done by answering with her "helper," and after testing in the same way completing the connection with the calling subscriber's cord, a slow, inconvenient and embarrassing method.

The advantages of a double over a single cord system are apparent at such time, and are equally so on Sundays, holidays, evenings and slack times generally, because an operator with the double cord may answer any call and complete the connection from any point at which she may happen to be, and also for the reason that the operator is not dependent on any one cord with which to make a connection, but may substitute another at any moment.

The last objection I shall name, but which, perhaps, is one of the most serious, is that the single cord system is not conformable to a purely metallic, nor to a mixed metallic and grounded circuit system, because of the impracticability of closing both sides of the metallic circuit when the plug is at rest on the key-board.

With our old switchboard, Western Electric standard, an operator was assigned to each 100 subscribers; with the new system each operator takes care of 150 subscribers, and does the work more easily than before. This is an important saving of 33⅓ per cent. in operators. In consequence of the changes which were made in operating the trunk lines the reduction was not so great as this.

In order to test the quality of the service rendered with the present system and to compare it with the service rendered at the sub-stations of this exchange, a special inspector was sent out with instructions to make test calls from all parts of the city, at all hours of the day and night, and for all points within the division. The results obtained in something over 1,500 calls are shown in the accompanying table. The calls were made by the subscribers themselves, in order to guard against recognition of the inspector's voice by the operator, and the result obtained is as fair a test of the service as it is possible to get. In explanation of the large percentage of "Don't answer" in the "failed" connections, I would say that the inspector frequently, when calling at night, asked for numbers that were sure to be closed, in order to avoid annoyance to subscribers, the object of the calls being to test the promptness with which operators responded at such times.

This compilation does not show results very greatly in favor of the multiple system, except in the greater number of subscribers assigned to each operator.

Our operators are instructed when answering a call to use the words "what number," and to repeat the number so that the subscriber may know that the call has been correctly received, and when ringing direct wire subscribers to give three distinct rings. The latter rule was made to guard as much as possible against subscribers being needlessly called to their telephones by ringing off, crosses, or other irregular ringing of their bells.

The convention then adjourned.

After the adjournment of the convention on Wednesday evening, Mr. A. S. Hibbard entertained a number of his friends at one of the leading German restaurants, where all enjoyed beer, music and solids to their hearts' content.

On Wednesday afternoon the convention visited the Minnesota State Fair and also took in the Pillsbury Mills. They were greatly pleased with what they saw at the latter place. A large number also went to the Exposition, and none of them escaped from knowing that there was a brass band tournament in town.

The kind attentions of Mr. S. S. Leonard, of the Minnesota Brush Company, of Minneapolis, were greatly appreciated by many of the delegates. Mr. Leonard threw his station open to inspection, and devoted his time to making the members at home and conversant with the points of interest in the city. Mr. Leonard gave, in fact, a good example of the fraternal feeling that should exist between electric light men and telephonists.

The only exhibits were the Beach-Cooke telephone transfer board, the Clarke instrument protector and the Law battery. An illustrated description of the first two of these was published in THE ELECTRICAL WORLD of Sept. 14th. Mr. M. M. Hayden, of the Law Telephone Co., looked after the interests of his house. The representatives of many of the electrical supply houses were on hand as usual, but did not display goods.

The delegates to the convention left New York on Sunday morning, Sept. 8, by special train on the Pennsylvania Railroad. The train consisted of two magnificent sleeping cars, a dining car, and a combination car containing smoking room, library, barber shop, bath room and baggage room. The train was lighted by electricity supplied from an Eickemyer dynamo run by a Brotherhood engine. Moveable electric lights were in all parts of the train and everything that could add to the comfort and convenience of the passengers was supplied. The trip was greatly enjoyed by the ladies, and their pleasure was increased by the presentation of a handsome bouquet of flowers by the New York & New Jersey Telephone Company to each. A very tasteful souvenir of the trip has been issued by General Barney, describing the arrangements, itinerary, etc., and the copies presented to the members of the party are highly prized. The General was presented, while on the train, with a handsome star and crescent diamond scarf pin from some of his appreciative friends.

The drive arranged for by the Northwestern Telephone Exchange Association took place in due course on Thursday morning, under the able management of Messrs. Glidden and McKinstry. After driving all around the beautiful city of Minneapolis, cars were taken to the Minnehaha Falls, where lunch was enjoyed. Train was then taken for St. Paul where the party again entered carriages and inspected the magnificient scenery and suburbs of that city. After the drive the party went to the Ryan Hotel, where a banquet had been provided by the Northwestern Association. Mr. Levi Sprague presided at the banquet, and Mr. Charles E. Adams, of the St. Paul Exchange, officiated as toastmaster. Speeches were made by President Sargent, Mr. T. D. Lockwood, Mr. W. D. Hall, the Secretary of the Minneapolis Board of Trade; Mr. C. W. Price, Secretary Barney, Mr. W. H. Eustis, Mr. Gustave Wabner, of Berlin; Mr. E. J. Hall Jr., Mr. J. M. Jackson, of the Western Electric Company, and Mr. Glidden. The banquet was graced by the presence of many ladies, and ended about 6 P. M.

Representatives of the Chicago and the Central Union telephone interests were on hand at the depot on the arrival of the train in Chicago Monday, at 9:30 A. M., and took their guests in carriages to the rooms of the Chicago Electric Club, where an informal reception occurred. At 12 noon a dainty lunch was served in Kinsley's, and about 1:30 the carriages were announced, when the guests to the number of seventy-four were carried along the Lake Shore drive through Lincoln Park to Fishers' Resort, on the shore of the lake, where additional refreshments were in readiness. Returning, the drive led through the opposite side of the park, affording a view of the flowers and the animals, and then down through the southern part of the city, finally ending at the depot at 5.10 P. M., in ample time to take their train for the Northwest. Everybody appeared highly pleased with all they had seen, felt perfectly satisfied to return in 1892, and expressed their thanks to the gentlemen who so ably managed the entire entertainment. The following gentlemen were present during the drive or at the club-rooms to assist in entertaining their guests or to meet old friends: F. G. Beach, general superintendent C. U. Telephone Company; C. H. Wilson, superintendent Chicago Telephone Company; E. M. Barton, president Western Electric Company; B. E. Sunny, president Arc Light and Power Company, Chicago; J. E. Hockett, superintendent C. U. Telephone Company, Indianapolis; F. E. Parker, superintendent Wisconsin Telephone Company, Milwaukee; John D. McLeod, Wisconsin Telephone Company; F. A. Forbes, general superintendent Michigan Telephone Company, Detroit; Charles E. Mosley, manager American Telephone and Telegraph Company, Kansas City; A. D. Bullock, president City and Suburban Telephone Company, Cincinnati; A. W. Crandall, Southern Bell Telephone Company, New Orleans; Capt. H. N. Gifford, general manager Ohio Valley Telephone Company, Louisville, Ky.; Mrs. Gifford and Miss Gifford; Wm. J. Maiden, C. U. Telephone Company, Chicago; J. C. Kinney, C. U. Telephone Company, Chicago; R. C. Wetmore, Chicago Telephone Company; J. J. Nate, Chicago Telephone Company; C. D. Crandall, assistant treasurer Western Electric Company; F. E. Degenhardt, agent Standard Underground Cable Company; Fred DeLand, THE ELECTRICAL WORLD, Chicago; W. H. Ellis, Chicago; C. C. Haskins, Chicago; M. A. Knapp, Knapp Electrical Works, Chicago; W. A. Kreidler, Chicago; G. A. McKinlock and William H. McKinlock, Central Electric Company, Chicago; F. S. Terry, manager Electrical Supply Company, Chicago; E. V. Cherry, Cincinnati; James R. Dee, Houghton, Mich.; Charles E. McCluer, Richmond, Va.; David B. Parker, New York.

Special Correspondence.

NEW YORK NOTES.

Office of The Electrical World,
167-177 Times Building, New York, Sept. 16, 1889.

A New Phonograph will, I understand, soon be put out in New York, and it is said to be superior to anything of the kind.

Mr. C. Z. Southard, electrician, of 1,418 Atlantic avenue, Brooklyn, N. Y., has issued, in pocket form, a table giving the carrying capacity of commercial copper wire in ampères, and 16 c. p. lamps for 50, 75 and 100 volts; also a table in the same folder showing the fall of potential in volts per ampère per 1,000 feet of circuit.

Mr. J. H. Vail has, I understand, been called upon to resume his old duties as chief engineer of the Edison Company, at headquarters. He will be missed at the Sprague office, but the call for his services is an imperative one, as the Edison Company has an immense quantity of work demanding immediate attention.

Mr. G. L. Wiley, of the Standard Underground Cable Company, has resumed work after a brief fishing vacation, and he is already piling up orders for the new factory to fill. Mr. Wiley is to be congratulated on the large business in wires and cables that he has worked up, requiring these new facilities for the manufacture of the goods.

The Edison Lamp Company, of Harrison, N. J., has issued a neat catalogue of low volt Edison lamps. It has a very interesting introduction, showing the variety of uses to which such lamps may be put, and instancing the special devices employed at Talmage's Church in Brooklyn; the Chicago Electric Club; Spaulding's jewelry store, in Chicago, and other places. It is pointed out that the hiring out of these small lamps on special occasions may be made a source of income for central stations. The company invite correspondence, and will be glad to furnish ideas or sketches for special installations. They are also authorized to furnish, for experimental purposes, the regular Edison lamps of high resistance.

The Brush Electric Company, of Cleveland, O., have finished and turned over complete to the New York Life Insurance Company all the large incandescent electric light plants installed by them in the New York Life Insurance Company's new buildings at Montreal, St. Paul, Omaha and Kansas City. These plants have a total capacity of 5,800 incandescent lights, the largest being the 3,000-light plant in the Kansas City building. No pains were spared either by the Brush Company or by the New York Life Insurance Company to make these plants as complete as any isolated plants in the country. The Watts-Campbell engines were used in Kansas City and Omaha, and the McIntosh-Seymour engines in St. Paul and Montreal. It is said that these New York Life Insurance Company office buildings are superior in every particular to any other buildings in the above cities.

The Mitchell-Vance Company, 836-838 Broadway, the noted makers of gas and electric fixtures, have devoted the basement of their large salesrooms entirely to electric fixtures. On the main floor an elegantly carpeted and decorated room is assigned to handsome electroliers, fixtures and brackets, and furnished with the electric current for exhibiting them to buyers in all their glory of illumination. This reception room alone is worth a visit to the store to inspect. This firm are fitting out the elegant home of Mr. Ferd. Peck, of Chicago, president of the Auditorium Association, with specially designed electroliers, fixtures and brackets in Early English and antique patterns. They sent a designer to Mr. Peck, and together they settled upon the handsome line of goods that are now being made in their big factory on Twenty-fourth and Twenty-fifth streets and Tenth avenue. This concern is said to have the most complete illustrated reference catalogues in the trade. They are in half a dozen volumes of large size for ready reference. A smaller catalogue for general circulation will be out shortly. W. T. H.

NEW ENGLAND NOTES.

Branch Office of The Electrical World,
Room 8, Cook Building, cor. Franklin and Congress Sts.
Boston, Sept. 14, 1889.

Benedict & Burnham, Waterbury, Conn., are extremely busy supplying the large and growing demand for their two special brands of electric line wire, the diamond B., and the F. and W.

Brookline, Mass.—The selectmen have taken into consideration the petition of the West End Street Railway Company, for authority to equip its lines in that town with the overhead electric system.

The Fort Wayne Electric Company has been admitted to the unlisted department of the Boston Stock Exchange, capital $3,000,000, in 120,000 shares of par value $25. H. G. Olds is president and H. J. Miller secretary, and the International Trust Company, Boston, transfer agent.

The Municipal Signal Company, Boston, have secured the contract for supplying Camden, N. J, with their celebrated police alarm signal apparatus. The contract calls for 20 boxes and central station and stable apparatus. It is interesting to note that the figures of this company were almost double those of the other bidders, indicating the esteem in which this system is now held by police authorities.

T. C. Perkins & Co., Hartford, Conn, report business brisk in general incandescent wiring and applications of power. This company handles as specialties the well-known Paiste & Bryant switches. Mr. Perkins expects soon to have orders for several large contracts, and is at present making a specialty of electric power, having installed in Hartford no fewer than five motors in churches for blowing the organ bellows.

The Mather Electric Company, Manchester, Conn., are enjoying good business in their dynamos for isolated lighting. They have recently shipped a 75-light plant to the Springdale Paper Company, Westfield, Mass.; 100-light plant to the Dalton Shoe Company, Dalton, Mass.; 150-light plant, with engine complete, to Fraser Farley & Co., Yokohama, Japan; 200-light plant to the College of New Jersey, Princeton, N. J., and a 200-light plant, for the laboratory of the Ohio State University at Columbus, O.

New Haven, Conn.—A serious fire broke out a day or two ago in the office of the Telephone Company of this city, and did about $4,000 worth of damage to the apparatus of the company before it was extinguished. There are about 1,400 subscribers, who were all cut off from service for the better part of one day. The Standard Electric Time Company, who were also in the same building, were damaged to the extent of about $3,000, though covered with $2,000 insurance. All the electric time clocks in the city stopped at three minutes to three o'clock, a few minutes after the fire broke out, thus involuntarily making a time record of the occurrence.

The National Pipe Bending Company, New Haven, Conn., have at present orders for 27 feed water heaters, averaging from 25 to 800 h. p. To aid them in their work they are now putting in a Thomson electric welding machine, for the purposes of welding iron, brass and copper pipe. Among their most recent orders may be enumerated the following: Two 400 h. p. heaters for the Electric Light Company, Osaka, Japan; one 200 h. p. heater for the Electric Light Company, Columbus, Ga.; one 200 h. p. and one 100 h. p. heater for an electric light plant in Philadelphia; one 800 h. p. heater for the Bridgeport Copper Company, Bridgeport; one 800 h. p. heater for the East River Electric Light Company, New York; one 500 h p. heater for Fulton County Railway, Atlanta, Ga.; one 300 h. p. heater for the Mauch Chunk Electric Light and Power Company, Mauch Chunk, Pa.; one 500 h. p. heater for the Bridgeport Electric Light Company, Bridgeport, Conn.; one 500 h. p. heater to electric light plant in Richmond, Va.; and one 500 h. p. heater for the United Electric Light Company at Springfield, Mass. A. C. S.

WESTERN NOTES.

Branch Office of The Electrical World,
39 Mallers Building, Chicago, Sept. 14, 1889.

The Salt Lake City Council have adopted the Gaynor fire alarm system at a cost of $7,000.

The Athens, Ga., City Council have contracted with the Athens Gas Company for street lighting.

Brookfield, Mo., celebrated the advent of electric lighting on her streets by a big jubilee on the 9th inst.

Aurora, Ill., has discarded electricity in the execution of vagrant curs, and again taken up the reliable shot gun.

H. A. Glasier, of the Jarvis Engine Company, made a call on his friends last week. His headquarters are now in Buffalo.

M. C. Chase, Chicago, is making some handsome primary battery cells of hard rubber for a manufacturer of physicians' batteries.

Fort Worth, Texas, is about to have an additional electric light plant, a local company having been formed with a capital of $100,000.

The Citizens' Street Railway Company, Indianapolis, commenced laying track on the 6th inst. for the Brightwood electric line.

Watertown, Wis., has given the contract for lighting her streets to a representative of the Thomson-Houston Electric Company, of Chicago.

The Warren, O., City Council are inspecting the various systems of street lighting preparatory to recommending the purchase of a municipal plant.

The Westinghouse Air-Brake Company at their annual meeting, July 31, reported that the net earnings of the company for the fiscal year just ended were $1,100,000.

The Duluth, Minn., Street Railway Company will build next summer an electric road from Twenty-fifth avenue west to West Duluth, a distance of three miles.

The Gleason & Bailey Manufacturing Company, Chicago, have just issued some wall cards containing handsome representations of their new incandescent goods.

Mr. C. B. Stephenson, representing the South Bend, Ind., Pump Company, has been exhibiting some handsome wooden cleats, etc., in this city during the past week.

The Marion, Ind., Street Railroad Company has been formed with a capital stock of $80,000; Directors: Eli Halderman, W. Halderman, Oscar H. Gale and Warren C. McWhinney.

Myron A. Knapp, of Chicago, has a "baby" on exhibition in his office. It only measures three inches by one and a half inches, with an internal resistance of 1½ ohms, and an E. M. F. of 2.1 volts.

The Citizens' Rapid Transit Company, Nashville, Tenn., has been formed by W. H. Mitchell, W. S. Jones and W. B. Rood, who have petitioned for the right of way for a new electric railway.

J. H. Branch, the Marengo, Iowa, banker, has been looking up the different electric lighting systems in Chicago during the past week, with a view to having the most suitable one installed in Marengo.

The Missouri Electric Company's linemen and pole-hole diggers struck in St. Louis last Monday for an increase in wages, although no complaint had been heard of since the men began working.

W. H. Pearson, Chicago, feels elated over his success in securing the contracts to furnish the entire steam plants for the city lighting, consisting of 16 Ideal engines of 125 h. p. each, 16 boilers, etc.

The Marr Construction Company, Minneapolis, have wired the Mammoth Museum and placed a 150 c. p. Westinghouse incandescent lamp in the hand of the statue of Liberty placed at the entrance.

Minneapolis, Minn., should secure the appointment of a city electrician, as the wiring in several fine buildings erected during the past four years has proven totally defective when current was turned on.

The Nubian Iron Enamel Company, Chicago, are supplying a handsome line of black enamel to the Western Electric Company and others in the electrical business, for use on dynamos, cables, etc.

The Knapp Electrical Works, Chicago, have issued a vest-pocket edition of the rules and requirements of the New England Insurance Exchange and Boston Underwriters' Union, adopted April 15, 1889.

The Edison Electric Light and Power Company, of St. Paul, recently offered to light the City Hall at the rate of 9½ mills per lamp hour for 16-c. p. lamps, and to furnish lamp renewals at 60 cents each.

Mr. Will W. Low, of the Central Electric Company, Chicago, has assumed charge of the retail department of that well-known supply house, relieving Mr. C. E. Brown, who is now traveling for the company.

George A. McKinlock, of the Central Electric Company, Chicago, returned from New York to day. While there he invited all his friends to make his office their headquarters during the summer of 1892.

The Electrical Accumulator Company, of New York, selected the right man when they placed William Hood in charge of their Cnicago office, as he is to be met with everywhere, is popular and progressive.

John W. Hefbun, president of the Underwriter Hatch Door Company, Chicago, has just returned from New York, where he secured the agency for the American Fire Alarm Company's system of protection for buildings, etc.

Mr. Joseph Flesheim, secretary and treasurer of the Menominee, Mich., Electric Light Company, is visiting friends in Chicago this week. Mr. Flesheim is heavily interested in real estate, and has closed one or two good deals of late.

The Armourdale & Kansas City Electric Railway line was opened for traffic on Tuesday of this week. All the machinery worked to the perfect satisfaction of every one. An extension of the line will be completed about Dec. 1.

Grimshaw Wires.—That there is a constant demand for the finer grade of insulated wires is shown by the statement made by the Knapp Electrical Works that they have sold nearly $50,000 worth of Grimshaw wires during the past two months.

The Rau Patent Oil Can Company, Chicago, have invented a simple device that enables them to convert their Perfection oil can into an air tight benzine can, specially designed for use by printers and others having the same class of work.

Charles W. Robison, manager of the Royal Electric Company, Peoria, Ill., has been in the city several times of late to complete, among other matters of importance, a handsome catalogue of their incandescent apparatus and constant potential motors.

The Duluth, Minn., Electric Company will remodel their station and increase their plant by adding an additional boiler, engine and dynamo. The company have secured the services of James McLane, of New York, as Superintendent and Electrician.

The Crescent City Railway Company, New Orleans, La., will have a completely equipped electric railway system, including 60 cars, in operation by Jan. 1, the necessary current for propelling the cars being supplied from the Gibson storage cells placed in each car.

H. F. Lufkin. of the C. & C. Motor Company, New York, has been in the city on a business trip, but has brought Mrs. Lufkin with him that she may the better appreciate the delightfully cool summer weather New Yorkers can enjoy when they come here in 1892.

W. J. Buckley, manager of the Chicago office of the Fort Wayne Jenney Electric Company, has placed a neatly-made miniature Star iron tower in the front of his office, from the top of which projects a large incandescent lamp that is kept constantly in circuit.

The Southern Electrotypers' and Stereotypers' Association of Atlanta, Ga., was formed on the 6th instant and the following officers elected: J. A. Wrigley, President; W. G. Sands, Vice President; M. P. McDermott, Secretary; S. S. Armstead, Treasurer.

Electric Club Notes.—Since moving to the new quarters, and especially since the dedication banquet, the daily attendance of the members has increased largely, every one feeling that it is just the place to drop in and meet some friends at noontime or in the evening.

Pueblo, Colorado, will have a "Mineral Palace," the framework being concealed outside and inside with ores of all kinds and handsome specimens of minerals, etc., while the interior will represent tunnels, drifts, shafts, and smelters, all illuminated with arc and incandescent lights

The Rae Electric System.—A company of Detroit gentlemen represensing the Rae system of electric street railway lines have been inspecting the route of the proposed West Side line in Kansas City, Kan., the investigations being made with a view to constructing the line under the Rae system.

The Charles Munson Belting Company have received an order from the Municipal Electric Lighting Company, St. Louis, for 400 feet of 48-inch double belting and 1,600 feet of 9-inch for dynamos. The Missouri Electric Company, St. Louis, have purchased three 20-inch leather belts from the company.

The Central Plank Road Company, Indianapolis, have brought suit against the Western Union Telegraph Company for rent alleged to be due on right of way over the road to Bridgeport, at the rate of $10 per day for six years, aggregating the sum of $21,900, for which the plaintiffs ask judgment.

The Rose Polytechnic Institute.—A recent application to this institution for an assistant electrician develops the fact that the services of all their graduates are generally secured as soon as the studies are finished. This should be a strong inducement to young men to take a course in electrical engineering.

The City and Suburban Telegraph Association, of Cincinnati, have filed a suit in a test case in the Cincinnati courts asking heavy damages from the street railway lines operating an overhead electric system, and that the system be so changed as not to interfere with the operation of the telephone system.

The Consolidated Electric Company are completing the installation of an extensive power service, and expect to have in operation by the 15th inst. electric generators of 300 h. p. capacity. The company propose charging $10 per month for the current for a 1 h. p. motor, and $120 for supplying current to a 15 h. p. motor.

Edward Lasell and Miss Alice Leigh Yeaton, only daughter of William Harper Yeaton, were married at the residence of the bride's parents, New Hampshire, on Wednesday, Sept. 4. Mr. Lasell is the president of the Southwestern Supply Company, Kansas City, Mo., and all his friends will join in congratulating him on his success.

A. H. Lewis, the Chicago manager of the Western office of the C. & C. Motor Company has sold a 10 h. p. C. & C. motor to the American Press Association; a 2 h.p. motor to the Religious Newspaper Company, Chicago; and to Cincinnati parties he has sold two 10 h. p., one 15 h. p., two 3 h. p. and two 2 h. p. motors during the last month.

The Central Electric Company, Chicago, realizing the delays incident to the securing of incandescent lamps when wanted, have started the manufacture of a high grade of lamps, designed for any system and made to fit any socket. They will also furnish to order incandescent lamps for battery use and series lamps for arc circuits.

George S. Bowen, of Chicago's suburb, Elgin, is strongly advocating a feasible plan of creating a demand in South America for our products and securing the bulk of the South American trade. The entire success of every movement with which Mr. Bowen has been prominently connected warrants the leading merchants in promoting the proposed plan.

The World's Fair. Messrs. B. E. Sunny, C. H. Wilson and E. H. Barton, the World's Fair Committee for electrical interests, have put forth subscription books and a book of blank receipts for the use of each member of the respective electrical committees. They urge activity in the matter and hope that electrical industries will make a good showing by Sept. 15.

"The Electrical World's Western Office," Chicago, was favored with a visit from Mr. and Mrs. W. N. Gray, of Cincinnati, last Friday. Among other visitors were Prof. John E. Davies, University of Wisconsin, Madison, Wis.; O. E. Guthrie, of Chicago drainage fame; George O. Fairbanks, district superintendent of the Westinghouse interests, and Ernst Hoefer.

A Big Belt Order.—Chas. A. Schieren & Co., of New York, have just received an order from the Municipal Electric Light Company, of St. Louis, Mo., for 400 feet of 48-inch double "Electric" belt, and 2,000 feet of 9-inch "Electric." It is said that this is probably the largest order for belting ever given out for an electric light plant in this country at any one time.

Luke Sharp, the Detroit *Free Press* writer, has an interesting sketch in last Sunday's issue, of the employment of the telephone by a physician to convey to a local editor an idea of the different sensations experienced while he was inhaling, with suicidal intent, the toxic gases given out by a charcoal fire, the editor having been requested to write same down for the benefit of science.

The Babcock & Wilcox Company issue yearly a work on "Steam: Its Generation and Use," that is one of the most useful and instructive books that the superintendant of an electric light plant, more especially a central station, can obtain, as a single perusal of its varied contents cannot help but result in some improvement in the economical management of the steam plant connected with the station.

Mr. Charlie Cone is going to be married. This happy event will occur on the 17th inst., at Ottumwa, Ia., and Miss Fannie McLaughlin will be the future Mrs. Cone. Mr. Cone is going to reside in Chicago hereafter, and his many friends throughout the entire country have concluded to send him a series of wedding presents in the shape of some big orders for Grimshaw wire, Perkins lamps or something of that character.

The Thomson-Houston Electric Company have sold, through their Chicago office, the following apparatus during this week: Joliet, Ill., Electric Light Company, 100 arcs; Champion Electric Light Company, Springfield, O., 50 arcs; Sioux City Gas Company, 85 arcs; Verdi Mill Company, Verdi, Nev., 18 arcs; Swanton & Clark, Santa Cruz, Cal., 650 alternating incandescent, being the second machine installed since April.

Dr. Robert D'Unger, a well-known physician and electrician of Chicago, was granted a patent on Aug. 27 for a telephone receiver and transmitter that is said to differ somewhat from the instruments now employed by the Bell companies, and which, it is claimed, is capable of transmitting speech a distance of 3,200 miles! It is reported that a syndicate will shortly establish exchanges in all the large cities in opposition to the system now employed.

Telephone Quotations.—Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes quotations on telephone stocks as follows:

Chicago	$305@$310	Cumberland	$ 68@ $70
Central Union	58@ 59	Wisconsin	114@ 116
Michigan	84@ 85	Bell of Missouri	150@ 152
Great Southern	32@ 33	Iowa Union	24@ 25
Colorado	36@ 38	Missouri and Kansas	57@ 58
Rocky Mountain Bell	40@ 42		

The Waukesha, Wis., City Council, at a special meeting of the village board held Sept. 6, adopted a resolution favoring the granting of a franchise for an electric street railway, and an ordinance will be presented at the meeting of the board, to be held the 17th inst., to further the enterprise. Fitch & Jarvis are the petitioners for the franchise, and they propose to construct three and a half miles of road and have it in operation within twelve months.

The Chicago Exposition opened its annual exhibit with the usual flourish last week, though many of the displays were not complete and there was little of interest to electricians, many of whom will recall the building as the one where the February meeting of the National Electric Light Association was held. The Sperry Electric Company are furnishing the arc lights, and have about one hundred in operation, the total number required amounting to 165.

Winona, Minn., was threatened with total destruction by a fire on Sept. 5, that consumed $300,000 worth of property. The building containing the water works plant and the electrical machinery of the Winona Electric Light Company, was partially destroyed, a press report states, but though the roof fell in on the boilers, the electrician, T. H. Botham, aided in keeping the lights burning and the city pumps going at the highest rate of speed till the fire was controlled.

The Central Electric Company, Chicago, have realized the fact that some action was required that would enable their customers to more quickly secure a high grade of incandescent lamps when needed, without being compelled to carry same on hand for long periods, and so have perfected arrangements for the manufacture of lamps for use on any system of incandescent lighting and for a special line of series lamps for use on arc circuits; and they report their facilities are such that orders for any number of lamps, designed to fit any socket, can be promptly shipped.

J. H. Siegrist, Jr., & Co., St. Louis, have just been awarded the contract to furnish the Ottumwa Street Railway Company, of Ottumwa, Iowa, with the Brightman mechanical stokers for the boilers in their new power house. The contract was given to them only after a thorough investigation by the superintendent of the railway company, who was sent to Chicago to see the stokers running at the large establishment of Wahl Bros. The company are also in receipt of the contract to put the stokers under two Heine boilers, at the new building now being erected for Mr. D. H. Houser, at Fifth and Chestnut streets, St. Louis.

Mr. J. C. Moore.—Many of the readers of the old *Operator* will be glad to hear that John C. Moore, formerly with the Franklin Telegraph Company, of Philadelphia, and later on press operator at Duxbury and New York, where he received the war dispatches over the French Cable line during the Franco-Prussian struggle, is now cashier of the United States Construction Company, Chicago, is in prosperous circumstances and nicely situated in every way. Some of his good fortune may be due to pluck and enterprise, but a large portion is credited to the progressive spirit diffused by *The Operator*, which he constantly read.

D. M. Benjamin, of Milwaukee, is building a handsome stone residence that will be wired throughout for some 200 incandescent lamps. An entire system of electric gas lighting will also be placed therein, and a 16 number Knapp annunciator and an 18 number Knapp burglar alarm. Over $700 worth of Okonite insulated wire will be used on this contract. A system of speaking tubes will be placed throughout the house with tubes running underground to the stable. Mrs. August Frank's stone residence on Prospect avenue, will also be wired in the same complete manner, as will the brick residence of W. W. Watkins, while thirteen other residences will be wired for electric gas lighting, Knapp annunciators and burglar alarms, bells, etc. The entire work is being done by the firm of Julius Andrae, of Milwaukee.

The Ohio & Michigan Anglo-American Storage Battery Company has been formed at East Saginaw, Mich., and duly incorporated. The shareholders are George F. Cross, E. Hallenbeck, Sandford Meller, W. C. McCline, J. H. Booth, W. E. Allington, W. H. Curtiss, H. L. Brintnall, John S. Porter and R. M. Randall, and the capital stock is $1,500,000, divided into 150,000 shares of $10 each. It has a lease of thirty years' life and is authorized to transact business in Michigan and Ohio, with the main office in this city. The principal business for which the company is formed is to buy, sell and deal in storage batteries and other electrical devices, and to furnish power, light and electricity for general uses. The company has secured the Sorley system franchise for the States named, the patents of which are owned in New York.

A. H. Bauer, the electrician of the Pullman Palace Car Company, Chicago, is engaged in fitting up the Montezuma special limited vestible train, which will run from Cincinnati to the city of Mexico, via New Orleans. All the electrical work will be of the highest character. A greater number of lamps than usual will be installed, and the new 23 M type of storage cell furnished by the Electrical Accumulator Company, of New York, will be employed. Mr. Bauer is also fitting up four coaches for the Monon route and two coaches for the Pan Handle route. Each of these coaches will be equipped with a separate set of cells of sufficient capacity to last the round trip, whether the car runs through to Cincinnati and return or only to Indianapolis, while the cells are so arranged that no removal is necessary in recharging, as the current is supplied direct to the cells by means of special circuits leading to the cars.

H. S. Connor, who has been for a number of years one of the principal experts of the Brush Electric Company, has taken charge of C. C. Curtiss' business during Mr. Curtiss' absence in Europe for the past three months. Mr. Connor sold to the Mississippi Mills, at Wesson, Miss., what is believed to be the largest electric light plant installed in any of the Southern mills. The plant is now being erected by the Brush Company, and consists of eight 45 light arc dynamos, with a total capacity of 360 arc lights, in addition to 150 incandescent lights. In addition to this plant, Mr. Connor has sold the following arc and incandescent plants: Woolen Mills, Louisville, Ky.; Louisville Bagging Company, Louisville, Ky.; New Albany Woolen Mills, Louisville, Ky. Mr. Connor is a nephew of N. S. Possons, the superintendent of the Brush Company, and if the first plant sold by him to the Mississippi Mills is any criterion of his ability, he will prove a valuable agent to the Brush Company.

Feed-Water Heaters.—It is a well-known fact that the greatest economy in both fuel and boiler capacity is secured when the water fed to the boiler can be raised to the highest temperature possible with the aid of the exhaust steam, or, where "economizers" are used, in utilizing the chimney gases, which are said to carry off about 50 per cent. of the fuel consumed. Manufacturers of feed-water heaters know that the average saving in fuel used is nearly 13 per cent. when water at the initial temperature of 60 degrees Fahrenheit is raised to 200 degrees Fahrenheit, while a saving of nearly one-fourth is effected in the fuel account if the apparatus used will permit the exhaust steam to raise the temperature of the water from 60 degrees to 300 degrees Fahrenheit before it is fed to the boiler. William Baragwanath & Son, Chicago, have issued a circular containing some hints on testing the temperature of feed water furnished to boilers that are of interest to owners of steam plants desiring to know just what the saving in fuel is.

J. Lang & Co., of 44 Michigan street, Chicago, have been very busy for some time past turning out a large and fine assortment of a new design in dynamo switches; also a large quantity of the Andrews "central switches." They are supplying these switches for the Elgin, Ill., watch factory plant of 9,000 Edison lamps, and the Chicago Auditorium with 10,000 Edison lamps. The switches used in these plants are from 100 up to 1,000 ampères capacity each. The firm are behindhand in filling large orders for the tight-fitting gas attachment, of which a cut was shown in the advertisement of the Electrical Supply Company on page 9 of Sept. 7, of THE ELECTRICAL WORLD. They have in hand at present a heavy order for plug switches of different capacities, with ½-inch, ⅝ and ¾ rod bearings. They are filling an order for Leonard & Izard of thirty-four 100 ampère Andrews switches, and 12 of 300, and have shipped a lot of 600 and 1,000 to Minneapolis. The dynamo switch is a fine one of 750 ampère capacity, and ten of them have been made for Leonard & Izard.

Increasing Brush Plants.—The following orders were received by the Brush Electric Company during the past month from parties increasing their present arc plants: Cambria Iron Company, 40 arc lights and dynamo; Scranton, Pa., Electric Light Company, 65 arc lights and dynamo; West Winsted, Conn., Gas Company, 15 arc lights; Allegheny County Light Company, Pittsburgh, Pa., 65 arc lights and dynamo; Brush Electric Light Company, Detroit, 46 arc lights; Union Stock Yards, Chicago, Ill., 15 arc lights; Albany, N. Y., Electric Illuminating Company, 95 arc lights and dynamo; Olean, N. Y., Electric Light and Power Company; Lapham Woolen Mills, Millbury, Mass., 45 arc lights and dynamo; Consolidated Electric Company, Denver, Colo.; Brush Electric Light Company, Rochester, N. Y.; Fort Madison, Ia., Electric Light Company; Brush Electric Light and Power Company, Galveston, Tex.; Minnesota Brush Electric Company, Minneapolis, Minn.; Brush Electric Light and Power Company, Indianapolis, Ind.; Menominee, Mich., Electric Light Company; New York Mills, No. 1, Oneida, N. Y.; St. Stephen Electric Light Company, Calais, Me.; Burlington, Vt., Gas Light Company; Passaic Rolling Mill Company, Paterson, N. J., 15 lights; Kennebec Light and Heat Company, Portland, Me., 45 arc lights and dynamo; Bigelow Carpet Company, Clinton, Mass.; Quaker City Dye Works, Philadelphia, Pa., 15 arc lights. F. DE L.

LOUISVILLE, Ky., Sept. 11, 1889.

Mount Vernon, Ind., will have a Thomson-Houston plant of arc and incandescent lighting running in a week.

The Central Thomson-Houston Company will put in Lebanon, Ky., 50 arc lights and 500 incandescent, alternating system.

Mr. Rigby, of the Marr Construction Company, of Chicago, is installing a plant of 1,100 Westinghouse lights in the Grand Opera House at Evansville, Ind.

The Kentucky Phonograph Company reports business as being good, but the manager, Mr. Campbell Scott, longs for a better battery for motive power.

The Gaynor Electric Company have secured the contract for their fire alarm system at Salt Lake City, and will proceed to install it at once. Their system is considered the finest and most rapid in use, from the fact that wherever exhibited they have always secured the contract, in spite of strong competition. F.

THE TELEGRAPH.

Birmingham, Ala.—The Southern District Telegraph and Electric Company are in search of points regarding storage battery roads.

The Direct Cable Company have been complimented by William Firth, Sons & Co. on a quick piece of work done on Sept. 9. The firm say: "At 10:05 A. M. to-day we handed an important cable for our Bradford house to your office at 444 Broome street. The reply reached Broome street at 11:04 A. M., and was in our hands before 11:15 A. M. Considering the various retransmissions necessary, and the messenger service in Bradford are all to come out of the elapsed 59 minutes, we think this record is good." There is certainly no encomium so well worth having as that of a well-pleased customer.

Western Union Dividend.—The directors of the Western Union Telegraph Company have declared a dividend of 1¼ per cent. upon its capital stock for the quarter ending Sept. 30. The company began the quarter on July 1 with a surplus of $8,611,401.78. The net revenues for the quarter (estimating the September business) are placed at $1,750,000, which, with the surplus, gives $10,361,401.78. Appropriations from this amount, including interest on bonds and sinking funds, reduce it to $10,151,401.78, out of which the current dividend, $1,077,385.38, comes, leaving a surplus at the end of the quarter of $9,074,016.40, an increase of $462,614.62.

Postal Company's Lines West.—A special dispatch from Portland, Ore., of Sept. 7, says: "The Postal Telegraph Company proposes building lines through Oregon and Washington, connecting interior points with the large cities on the Pacific Coast. The service is intended to be complete, and operations will be begun early in the spring. John W. Mackay's private secretary was in the city a few days ago, and is authority for the above statement. He further said that during the remainder of the present year the Postal Telegraph Company would spend over $4,000,000 in building lines through the Southern States. One line will be run along the Atchison, Topeka & Santa Fe road to the Pacific Coast."

To Enforce an Injunction.—Papers were filed on Wednesday, Sept. 11, in the United States Circuit Court in the suit of the Boston Safe Deposit and Trust Company against the Bankers' & Merchants' and the United Lines telegraph companies, John G. Farnsworth, Edward S. Stokes and others, and the American Rapid Telegraph Company. In April Judge Wallace granted an injunction in the suit, and the defendants were ordered not to use certain lines belonging to the American Rapid Company, on which the Trust Company held a mortgage, and it was further ordered that the property be turned over to Receiver Harland, of the American Rapid Company. An extension of time was obtained by the defendants until Sept. 1, and it was supposed that the injunction order was to be obeyed. As it was not, the injunction was put in force.

THE TELEPHONE.

Upper Sandusky, O.—Chief Fire Engineer W. S. Coon is inquiring for "the names and addresses of firms constructing telephone systems."

Increasing Bell Telephone Stock.—At a special meeting of the Bell Telephone Company directors on Sept. 12, the act of the Legislature authorizing the increase of the company's stock was accepted, and it was voted that the capital stock be increased from $10,000,000 to $12,500,000, that the number of shares be increased from 100,000 to 125,000, and that the stockholders be entitled to take additional stock in the proportion of one new share for every four shares now held by them.

The Government Telephone Suit.—A dispatch from Boston of September 9, says: An opinion was given by Judge Colt, in the United States Circuit Court to-day, favorable to the defendant, in the case of the United States of America against the American Bell Telephone Company. In this case the defendant company has filed a general answer to the bill, and the defendant, Bell, has filed a plea and answer in support thereof. The defendant company now asks leave to withdraw its answer and file the same plea and answer in support thereof which has been filed by Bell. The motion has been granted by Judge Colt.

A Neat Method of "Laying Up" Cables.—The plan of ordering cables laid up regularly or in twisted pairs and then using the conductors for either grounded or metallic circuits, promises to become both popular and profitable in the telephone field. Anything that will enable the telephone companies to utilize fully the cables they purchase is welcomed by them. They thus avoid heavy outlays of cash for cables in anticipation of metallic circuit demands. The New York & New Jersey Telephone Company transpose all their cables at Brooklyn and Newark with most satisfactory results. Superintendent Frank Mason has taken advantage of this method to break up the cross-talk in several of his police telephone cables, and seems to be happy over the result. Inquiries regarding the transposition method are pouring in on General Superintendent Reilly, the inventor, from not only all over this country, but from Europe and Canada.

Made Deaf by the Telephone.—At a recent meeting of the Societe de Biologie, Dr. Gelle read a note on the ill effects of audition by the telephone. He stated that he had on many occasions observed them. The first was that of a man of great intelligence, occupying a position which obliged him to listen sometimes almost incessantly to telephonic communications. The result was a state of nervous excitement and hyperæsthesia of the hearing and of the ear itself to such a degree that the sounds caused vertigo and ringing in the ears, and led to persistence of alarming vertiginous sensations. Complete rest was sufficient to remove these troubles. In another case a young employé in a large establishment who had to attend to telephonic messages felt her ear becoming rapidly weak, and it was soon the seat of noises and of a remarkable hyperæsthesia, and at the same time the hearing became painful. In this case also perfect rest and the cessation of her work almost completely cured her of these symptoms.

The Drawbaugh Pool.—A Washington paper says: "A sort of anti-Bell telephone pool has been formed. This has been done by combining the diversified interests of the Drawbaugh claims. A paper has been filed in the patent office by which the People's Telephone Company has assigned all its rights and title to the various sixty patents and applications for patents which it controlled to three mutual trustees—Frank Jones, the millionaire brewer of Portsmouth, N. H.; John R. Bartlett and Henry C. Andrews, of New York. These men originally represented only the Drawbaugh interests. They were the generals in the big six-year fight which was lost, and they are in for another to the death. The result of this assignment is to concentrate all the elements into a strong working force. It is this force upon which the government case mainly rests for success. The mass of testimony which was brought out in the former trial is all available for this new one in Boston; but the Drawbaugh side has obtained some new evidence which renders its case stronger than ever it was before, and the government will be given the benefit of this in its suit against the Bell company."

THE ELECTRIC LIGHT.

Baton Rouge, La.—Mr. J. D. Fisher will, it is said, put in a plant.

New Orleans, La.—The Edison Company are going in for big extensions.

Shreveport, Ala.—Mr. J. R. Jones has bought the incandescent plant.

Brenham, Tex.—Mr. F. P. McMullen is organizing a local Edison Company.

The Mountain Lake Park Company, La., will put in an electric light plant.

Macon, Ga.—The Macon Brewing Company will put in an arc and incandescent plant.

The Eufaula Gas Company, of Eufaula, Ala., will put in a Thomson-Houston plant.

Wheeling, W. Va.—The Wheeling Electric Light Company are putting in new boilers.

Waycross, Ga.—Mr. M. Albertson has a contract for city lighting, and will put in a plant.

Corinth, Miss.—Mr. J. D. Liddon proposes to build a combined ice factory and electric light plant.

Rocky Mount, N. C.—The Rocky Mount Mills will put a lighting plant in their new cotton mills.

Cordele, Ga.—A plant is to be put in by Mr. J. B. Felder, of Americus, or by J. E. D. Shipp and others.

The United Edison Manufacturing Company has recently increased its capital stock from $100,000 to $500,000.

Vicksburg, Miss.—The Louisville, New Orleans & Texas Railroad Company, of Memphis, Tenn., will put in an electric light plant at their new shops.

Lynchburgh, Va.—Proposals for lighting with about 140 lamps of 1,500 c. p. will be received by chairman J. D. Sullivan, of the committeee on light, until October 1.

Dallas, Tex.—Clower & Harris have been awarded the contract for lighting the coming Texas State Fair and Dallas Exposition with Sperry arcs and Heisler long-distance incandescents, the number of lights required being larger than ever before.

Matlack & Falvy, of Louisville, Ky., large plumbers, gas-fitters, etc., are out in the local papers with a flaming advertisement directed against the "Gas and Electric Light Fixture Manufacturers' Association," which they characterize as "a conspiracy against the public," to raise prices

The Subway Board.—A meeting of the New York Subway Board was held last Thursday, Sept. 12, when a variety of routine business was done. The Mount Morris Electric Light Company applied for a permit to run about six miles of wire overhead. The application was referred to Mr. Wheeler for report.

Elizabeth City, N. C.—Poole & Guirkin, of Lynchburg, Va., have adopted the series incandescent system for street and commercial lighting, using the Eickemeyer dynamo and Sawyer-Man lamps. They expect to have the plant in operation by Oct. 10, and will start up at nearly the full capacity of the machine.

Buenos Ayres, S. A.—Mr. C. V. Boisot, agent for the Edison Company, has secured a contract for lighting the suburb of Adrogue with the Edison municipal system. A company has been formed to put in the plant, of which Dr. D. E. Arana is the president; Don J. Ovando secretary, and Don J. Sanchez the treasurer.

The Oerlikon Works' tender has been accepted for the central station in Zürich, Switzerland. Direct current dynamos of the well-known Oerlikon type will be employed for the arc lighting and Kapp alternators for the incandescent lamps. The distribution of the alternating currents will be made from large sub-station transformers.

Allegheny City, Pa.—The bids for furnishing a plant for Allegheny City, Pa., were opened last week. The Indianapolis and Fort Wayne Jenney companies made a joint bid. Their figures and those of the Westinghouse Company were substantially the same—the amount being $140,000. The Westinghouse Company secured the contract for the electrical apparatus, and the Jenney interests that for 52 towers and 100 mast-arms.

Brush Incandescent Plants.—The following orders for incandescent plants were received by the Brush Electric Company during the past month: Charleston Cotton Mills, Charleston, S. C.; Pulp Mills, Waterville, Me.; Island Lumber Company, Sturgeon Bay, Wis.; A. J. Lawson, Montreal, Can.; Kilby Manufacturing Company, Medicine Lodge, Kan.; Kilby Manufacturing Company, Ness City, Kan.; Shawmut Fibre Company, Shawmut, Me.

The Scranton Electric Light Company, owned by the Scranton Gas & Water Company, purchased four 65 arc-light dynamos of the Brush Electric Company some time last year. Since then they have purchased five additional 65-light Brush arc dynamos, and now have a total capacity of 585 arc lamps. Their station is one of the best arranged in the country, and their entire plant, including their street circuits, one of the most complete.

The Commercial Electric Company, of Detroit, have but recently organized, but they are already busy. They will shortly begin the construction of their plant for commercial lighting. They have just completed a 500-light incandescent plant for the Wonderland Theatre, at Buffalo, N. Y., and are installing a 300-light incandescent plant in F. K. Stearns & Co.'s laboratory, Detroit. General business is good, and their prospects for a large fall business are quite flattering.

A New Consolidation.—We learn that the Fort Wayne Jenney and Indianapolis Jenney Electric Light Companies have been merged in the new organization known as the Fort Wayne Electric Company, recently incorporated with a capital stock of $300,000 fully paid up. Mr. Brainard Rorison, the secretary of the Indianapolis company, under whose management that company has become so prominent a factor in the electrical world, takes a considerable interest in the stock, and has been elected secretary of the new corporation.

New Brush Arc Plants were contracted for last month as follows: Barron, Forbes & Co., City of Mexico, Mex., 65 arc lights and dynamo; Perdue University, Lafayette, Ind., 10 arc lights and dynamo; Doggett Drygoods Company, Kansas City, Mo., 50 arc and 250 incandescent lamps and dynamos for same; Mississippi Mills, Wesson, Miss., 360 arc and 150 incandescent lamps and dynamos for same; Citizens' Gas Light Company, Port Chester, N. Y., 55 arc lamps and dynamo; Navy Yard, Washington, D. C., 120 arc lamps and dynamos for same; Manhattan Electric Light Company, New York City, 260 arc lights.

The Detroit Electric Light & Power Company has been formed at Detroit, by Messrs. Fitzgerald, Fisher and others prominently connected with the Commercial Electric Company. Mr. R. T. McDonald, of the Jenney Electric Company, holds individually and in trust, 5,800 shares of the stock, or a little less than the local holdings. The capital stock is $490,000. The plant will be established at Randolph and Woodbridge streets, and the company will make a big push for the local lighting and other "plums." It offers to put all its wires underground. Mr. W. B. Moran is president; Mr. G. W. Lee, vice-president; Mr. J. B. Moore, treasurer; and Mr. W. H. Fitzgerald, secretary.

The Hill Clutch Works, through their Eastern manager, Mr. Walter C. Wonham, inform us that they have opened an engineering office in the Cook Building, 146 Franklin street, corner of Congress, Boston, Mass. Mr. L. J. Hirt, whose engineering ability is too well known to require any comments by us, is in charge of this office. Electric light station men all over the East will, we are sure, be pleased to hear of this move, as it brings the engineering department of the Hill Clutch Works very near to them. The reputation of these Works for high grade work is so well established and their friction clutches are so universally used and well liked, that it would be superfluous to say anything further about them. We wish their Boston office great success. The business affairs of the works for the East remain under the management of Mr. Wonham, at 18 Cortlandt street.

The Edison Business in Canada.—The Canadian Edison Company are advertising for steady, willing men to work at their factory in this city, and should find no difficulty in securing such. This company are expanding and developing their works in this city to a degree that will soon make them among the foremost manufactories in Sherbrooke. They are at present engaged on a very large order for underground electric wires for the city of Toronto, and they are also getting ready to make electric motors as well as dynamos and all other electrical appliances. They have been enlarging and increasing their facilities for manufacturing these goods, and when all is in readiness will be one of the most convenient and perfect establishments in the Province. Mr. Langton is the manager here and Mr. Madgett is the foreman.—*Sherbrooke Gazette.*

Westinghouse Plants.—The follow ing orders for central station alternating current apparatus were received by the Westinghouse Electric Company during the month of August: Dennison, Tex., 1,500; Newark, N. J., 750, inc.; Freeport, Ill., 750; Albion, N Y., 500; Rutherford, N. J., 750; Marquette, Mich., 750; Schenectady, N. Y., 1,500, inc.; Elmira, N. Y., 750; Sprague, Wash., 500; Sewickley, Pa., 750; New York, N. Y., 6,000, inc.; Hartford, Conn., 1,500, inc.; North Yakima, Wash., 500; Providence, R. I., 2,000, inc.; total, 19,000 16 c. p. lights capacity. The following arc machines for central station purposes were sold during the month: Albion, Ill., 50 lights; Auburn, Ind., 35 lights; Sewickley, Pa., 30 lights; North Yakima, Wash., 35 lights; total, 140 lights. Up to the first of September of this year the orders received for the Shallenberger meter aggregate 175,000 16 c. p. lights capacity. Hence it will be seen that the meter is being rapidly introduced among the stations. Its workings give general satisfaction,

Pennock's Plunder.—A special dispatch from Chattanooga, Tenn., of Sept. 7, says: A sensation is brewing here among the directors and stockholders of the Pennock Electric Light Company, and there promises to be very interesting developments. The directors held a meeting to-day, and a stormy time was the result. It seems that the stockholders were to pay George B. Pennock, the patentee of a storage battery electric light, $7,000 for the State right in Tennessee. For this Pennock was to put in an exhibition plant, which was done, and the light worked very well until Pennock got all the money and left town, since which time the light has gone out. The plant cost the company $1,000, and on inventory, it is said, revealed about $200 worth of stuff. A committee was appointed to investigate things. Pennock now claims that the company was to pay him $15,000 for his State right, and the company deny this. George Pennock is absent, and his return is anxiously hoped for by the people who have apparently lost their money. Pennock has been trying to organize companies in Memphis and Nashville, and it is said a number of good citizens in both cities have taken stock. The stockholders here are free in denouncing Pennock. The affair will develop next week.

APPLICATIONS OF POWER.

Roanoke, Va.—The Roanoke Street Railway is to be run electrically by Mr. M. M. Rogers, who has bought it.

The South Nashville, Tenn., Street Railway Company will adopt the Short series railway system.

Creighton, Ga.—Mr. D. Tibbett, secretary of the Franklin Gold Mine, wishes for estimates on operating an electric power plant cheaply by water.

Richmond, Va.—Mr. W. B. Gay, representing Boston capital, has bought the Manchester Railway and Improvement Company to operate it by electricity.

Warrensburg, Mo.—A thirty years' franchise for the electric road has been granted to the Electric Springs Company. The road will be put in operation at once.

St. Paul, Minn., has granted franchises for four electric roads, one of which is very comprehensive, and will be built by the Thomson-Houston Company.

Newport, Ky.—The South Covington and Cincinnati Street Railway Company are preparing to operate the Newport division by electric motor, and have secured a franchise from the city council.

Kansas City, Mo.—It is now proposed to adopt electricity for the Kansas City Elevated road, superseding the cable plant, and the subscriptions to the stock are already so large as to insure the making of the change at once.

The Metropolitan Street Railway Company, Kansas City, has put its new electric road in successful operation, and there is now great likelihood that the Fifth street line will follow its example, and will abandon its cable system, which has operated very badly

The Weems System.—Mr. D. G. Weems has applied for the exclusive right of building an electric road all around the New York World's Fair in 1892. He promises a speed of five miles a minute, and says that the passengers will travel "safely and in great luxury.

The Julien Electric Traction Company issued recently a neat little pamphlet giving a number of detailed estimates as to the cost of operating street railways by horse, cable, conduit system or storage battery. The figures in the last case are based on the work done on the Madison avenue road by the Julien cars now running there.

The Biter Bit.—Mr. E. Tracy, a resident of Albany, N. Y., obtained a temporary injunction against the Troy & Lansingburg Railroad Company, restraining them from erecting poles for the electric road in front of his property. When the case was heard the judge vacated the injunction, holding that the poles would not inconvenience plaintiff, and that if the injunction were not vacated, delay would be caused in a matter involving the public utility. The company intends to sue Tracy for $25,000 damages for the delay already caused by his action.

Storage Battery Litigation.—Judge Lacombe, of the United States Court, sitting in Brooklyn, N. Y., has granted a temporary injunction against the Brooklyn Incandescent Electric Light Company, upon the petition of the Electric Accumulator Company, to restrain the Brooklyn Company from using certain secondary or storage batteries constructed under patents issued to C. A. Faure, in January, 1882, and to John S. Sellon in 1889. The complaint charges the defendant company with an infringement of their patents, which the plaintiff company claims to have been assigned to to it. A similar injunction was issued by the same judge last week upon the petition of the same company against the Mutual Electric Manufacturing Company.

The Robinson-Foster Company.—A dispatch from Peabody, Mass., of Sept. 6 says: A lively and well-attended meeting of the stockholders of the Robinson-Foster Electric Motor Company was held at the factory this afternoon. A statement was submitted by the directors showing the financial condition of the company. It was proposed that the company raise $15,000, the amount necessary to carry on the works, by asking the stockholders to subscribe the money, receiving preferred stock therefor. No action in that direction was taken, but a committee of five was appointed to examine the books, inquire into the previous condition of the company, and to report the result by circular to the stockholders as soon as possible. The factory will remain closed until after the annual meeting, which will be held Sept. 25, when some decided action will be taken.

Broadway, New York.—The New York *Times* says: "The Broadway Street Railroad Company is following out the line pursued by various companies recently, and is seeking for a motive power to take the place of horses. An electric car, run by the storage battery system, is now being tested upon the track from Fiftieth street and Seventh avenue to Central Park, and passengers from the Seventh avenue line often have an opportunity to travel on the car at the upper end of the line. The Broadway road would be about as hard a line to operate with electric cars as could be found, owing to the amount of trucking on the great thoroughfare. Engineers interested in the electric systems argue, however, that the cars could be run about as well by electricity as by horses. The company, however, has made no decision as regards the cars, and is simply experimenting." The car in question is that of the Electric Car Company of America.

A Good Record from Buffalo.—Among the cities which are now adopting electricity as a motive power on their roads is Buffalo, N. Y. The Buffalo Street Railway Company about two months ago made a contract with the Sprague Electric Railway and Motor Company, of New York, for the equipment of four electric cars. This equipment was intended only to try the electric system, and if the trial should be successful it was contemplated that an equipment of a very large number of cars would be operated upon this road. The cars have been in operation about four weeks and carry large numbers of passengers. Upon a recent Sunday, the four cars and four trail cars carried 25,000 passengers without the loss of a single trip. This is a notable record, considering the small number of cars operated and the grades upon this line. The people in Buffalo are enthusiastic over the new system of propelling street cars, and it is said that the management will soon give an order for an increased equipment.

PERSONALS.

Mr. J. R. Davis has been appointed general manager of the Pennsylvania Telephone Company, with headquarters at Harrisburg, Pa.

Mr. Fred. Reckenzaun, of the Electrical Accumulator Company, has recently returned East from San Francisco, and will leave this week for Europe to take a long and well-earned vacation.

Mr. T. A. Edison has given 10,000 francs to the poor of Paris. He thus closes in a happy manner a visit that has been remarkable in many ways, and that recalls the honors paid to Franklin by the French people.

Mr. Davison Dalziel, of this city, has established a new cable news agency as an open competitor with the Reuter agency, and has made contracts already with some of the leading English papers to furnish them with daily American news.

Mr. Frank E. Fisher, the electrician, of Detroit, was married at San Jose, Cal., on Aug. 14, to Miss L. Bethel, a daughter of the late Mayor Bethel, of that city. Mr. and Mrs. Fisher will take up their residence in Detroit the latter part of this month.

Mr. F. A. Beelen, the Chilian Consul General, states that the article that appeared recently in THE ELECTRICAL WORLD, by Mr. H. L. Webb, on Chilian cable projects, has been copied in the Chilian newspapers, and read with much interest in the Republic. The Chilian scheme will be carried out very shortly.

M. Julien, of Brussels, the inventor of the well-known Julien system, in operation on the Fourth avenue line, this city, has been awarded the Gold Medal at the Paris Exposition for his storage batteries there shown. This is regarded as of importance, being confirmatory of the awards obtained by him for his batteries and system of storage battery traction at Antwerp, in 1885, by the well-known International Congress appointed by the government to report as to the best manner of the propulsion of tram cars, Paris in 1886, and at Brussels in 1888, when the Cross of Leopold was presented him for the invention.

MISCELLANEOUS NOTES.

The Johnstone Conduit will be given a trial for underground work in Denver.

Berlin, Germany.—Mr. Edison is visiting Berlin, and consulting, it is said, with Herr Siemens as to plans for more extensive lighting in Berlin.

The Thomson-Houston Electric Company, it is said, employs the largest number of stenographers of any firm in New England. At their Boston office they have 22, and at the big Lynn factory 12. Ladies are in the majority.

BUSINESS NOTICES.

Battery Cut-Out.—Attention is called to a simple device for disconnecting gas-lighting batteries if accidentally grounded. It is cheap, sensitive, never needs watching, and has no clockwork to be kept wound. Terms furnished by the Electric Supply Company, of Syracuse, N. Y., No. 105 South Warren street.

Patterson, Gottfried & Hunter (Limited), 146-148 Centre street, carry a complete stock of Brush copper, celluvert fibre oiled paper, hard rubber, rod and sheet brass, brass, copper and iron wire, self-hardening tool steel, set and cap screws, machine bolts, machine and wood screws, taps and dies, files and twist drills, blowers and forges, machinery, tools and hardware, gear wheels, wood pulleys, shafting hangers and belting. General factory supplies.

The Wilmot & Hobbs Manufacturing Company, of Bridgeport, Conn., have recently been putting in a quantity of exceedingly heavy drawing machinery, capable of drawing smooth cold rolled steel, brass or copper shells, of various diameters up to 8 inches by 6 inches, or 8 inches deep. One of the peculiarities of this machinery is, that the drawing punch has a quick return stroke, giving great power when drawing, and losing little time between operations. They are doing a great variety of this work, and have been running till 9 P. M. on some special press work, besides running their rolling mill department overtime

Owing to the pressure on our columns, the Patent Record has been omitted this week.